United States Department of Agriculture
Forest Service

Rush Skeleton Weed Project

Environmental Assessment

Beckwourth Ranger District, Plumas National Forest, Plumas County, California

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Chapter 1: Introduction

We are proposing to treat the noxious weed known as rush skeleton weed with herbicides in the Rush Skeleton Weed Project (the project) area. The Proposed Action would also include treating the weeds by hand pulling, digging, and covering with tarps. Revegetation is proposed if noxious weed treatments result in bare soil. Specific resource management measures designed to minimize potential adverse effects of herbicides on natural resources; and, monitoring will be implemented as described in the Mitigation section below. A full description of the proposed actions is provided in Chapter 2. These actions are proposed to be implemented on the Beckwourth Ranger District of the Plumas National Forest.

We prepared this environmental assessment (EA) to determine whether implementation of the proposed action may significantly affect the quality of the human environment and thereby require the preparation of an environmental impact statement. By preparing this EA, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA). For more details of the Proposed Action, see the Proposed Action and Alternatives section of this document.

Background

Rush skeleton weed was found at the Discovery Placer Exploration Project (hereafter Discovery Project) area on Eureka Creek in the summer of 2013. The Discovery Project proposes to use a backhoe to dig 10-20 pits, each up to 4 feet wide, 20 feet long and 15 feet deep. Also proposed are: a processing area of 50 x 100 feet, a water holding trough of 10 feet by 10 feet by 10 feet deep, a wastewater pit of 20 feet by 10 feet by 10 feet deep, use of up to three camp trailers, personal vehicles, a 12-foot portable trommel wash plant, and a portable toilet. These activities are all proposed to occur within the known existing rush skeleton weed population.

Roots of rush skeleton weed are easily fragmented and pieces as small as 0.5 to 1 inch can produce new rosettes from a depth of 3 feet (DiTomaso et al. 2013). Rush skeleton weed primarily reproduces vegetatively but can also reproduce by wind dispersed seed. Seed or root fragments may be introduced into new areas via transportation corridors such as roadways. Rush skeleton weed may also spread through attachment of propagules that adhere to the undercarriages of off-road vehicles and equipment. The most rapid spread appears to occur at mid-elevation areas (USDA 2012). This type of disturbance is likely (USDA).

The types of activities proposed by the Discovery Project increase the risk of spread of this weed. The vehicles and equipment proposed for use provide vectors of transport of weed propagules. The proposed activities would sever roots and create many fragments that can be spread and establish new infestations. The ground disturbance and the related removal of existing plants at the site create conditions that are favorable for seed germination and any germinating rush skeleton weed seeds would have a competitive advantage over native plants. Once rush skeleton weed is established, grasses are unlikely to successfully compete for water and nutrients (USDA 2012).

The Rush Skeleton Weed Project is proposed as a mitigation measure to the Discovery Project to reduce the risk of spreading the known rush skeleton weed infestation. It is also, however, an independent project planned to be implemented regardless of the Discovery Project.

The infestation currently covers approximately 1.1 acres and is estimated to include 3000 plants. The infestation may be larger and the rate of spread is not known because the infestation has only been known for two growing seasons. The potential for rapid spread of rush skeleton weed is high once it is introduced into an area with favorable conditions. (USDA 2102).This invasive species has spread to cover several million acres in western US. (Whitson et al. 1991). Based on this information, we anticipate that the infestation, if left unmanaged, would be likely to rapidly increase in density and area as well as spread to new locations. The infested site is used for dispersed camping and mining activities are being proposed there for the Discovery Project.

In summers of 2013 and 2014, the infestation was treated several times by hand pulling plants prior to seed production. The infestation was mapped using Global Positioning System (GPS). Hand pulling helps to reduce risk of spread but is not reported to be an effective means of eradication. This treatment has greatly reduced seed production but did not kill plants. Without effective treatment there is a very high risk that rush skeleton weed will spread, invading additional acres nearby and potentially spreading throughout the Jamison Creek watershed and the nearby Plumas Eureka State Park. Rush skeleton weed reproduces by seeds and root fragments. The seeds are wind dispersed and are equipped with pappus (commonly known as a parachute). As the populations grow they become more costly and impractical to control. Noxious weeds can crowd out native plant species, reducing habitat for sensitive plants and wildlife.

Rush skeleton weed is an “A” rated noxious weed in California (CDFA 2014), which is defined as a pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment. A-rated pests are prohibited from entering the state and are “detrimental to agriculture”. If found entering or established in the state, A-rated pests are subject to state (or commissioner when acting as a state agent) enforced action involving eradication, quarantine regulation, containment, rejection, or other holding action.

Rush skeleton weed is considered a high priority for control and eradication in Plumas County (Personal Communication, Tim Gibson, Plumas-Sierra Counties Agricultural Commissioner). The Plumas County Agricultural Commission has been treating rush skeleton weed on private land approximately 4.5 miles southeast of the project area.

Proposed Project Location

The project is located on the Beckwourth Ranger District of the Plumas National Forest, Plumas County, California. It is part of the Mohawk Management Area, management area #34 (USFS PNF 1988). The weed infestation occurs on both sides of Eureka Creek alongside forest service road 23N37. The site is commonly used by the public as a dispersed campsite. It is also the site of the proposed Discovery Mine project. The legal description is: Township 22N, Range 11E, Section 1, SE ¼ of NE ¼. The project area includes two discontinuous land areas (figure 1) that are not currently infested with rush skeleton weed. Those areas would be treated only if rush skeleton weed is found during the life of the project.

Need for the Proposal

As part of the planning process for the project, an interdisciplinary team worked with the decision maker to compare existing conditions in the project area with desired conditions (as described in the Plumas National Forest LRMP, as amended) to identify potential actions needed to progress toward the desired conditions. This section describes why the Forest Service is proposing to act now, what actions are needed, and what mitigations might be required.

1. Action is needed to prevent an increase in density and area of the existing infestation and the establishment of new infestations.

If no treatment is done it is likely that the number of plants and the area of the infestation would likely increase rapidly. This species reproduces vegetatively and by seed. The area has been disturbed by mining and recreational use. These disturbances have resulted in bare soils that are highly susceptible to weed infestation. The existing condition of the site is conducive to establishment of weeds in general and rush skeleton weed in particular.

If no treatment is done seeds and plant fragments are likely to be transported into the surrounding areas. Natural and human activities both provide mechanisms of transport. Root fragments of 1 to 2 centimeters in length can produce new plants even if the fragments are buried in soil to a depth of 3 feet. Seeds and fragments may adhere to the undercarriages of off-road vehicles and road maintenance equipment. The most rapid spread appears to be at mid-elevations (USDA 2012 Chondrilla field guide). The elevation of the known infestation is at 4500 feet above sea level.

Existing Conditions –

Approximately 1.1 acres are infested with rush skeleton weed in the project area. Monitoring at the site shows that the density of rush skeleton weed plants has increased in one year.

Desired Conditions –

A native plant community and the absence of rush skeleton weed are desired conditions.

2. Action is needed to mitigate the effects of the Discovery Mine Project that is proposed at the site of the infestation. The actions proposed in the Discovery Mine Project are likely to increase the risk of spread and to density of the existing infestation.

The mechanical disturbance proposed in the Discovery Mine Project would create habitat that is highly suitable for rush skeleton weed. The proposed actions would remove competing vegetation and leave behind bare tilled soil. In rush skeleton weed treatments tillage is not recommended. Deeply growing severed roots will quickly regenerate new stems and plants (USDA 2012 Chondrilla Field Guide) Although revegetation is also proposed after the mining activities, the rush skeleton weed that is already established at the site would have a competitive advantage.

Vehicles and motorized equipment proposed for use in the Discovery Mine Project can transport seeds and plant fragments. These can be deposited elsewhere in the forest and develop into new infestations. Each rush skeleton weed plant can produce up to 10,000 seeds per year (NRCS 2009 Ecology and Control).

The 2004 Sierra Nevada Forest Plan Amendment contains the following direction: As outlined in the Regional Noxious Weed Strategy, when new, small weed infestations are detected, emphasize eradication of these infestations while providing for the safety of field personnel (SNFPA pg. 55).

The Forest Service Manual contains the following direction (FSM 2902):

All National Forest System invasive species management activities will be conducted within the following strategic objectives:

1. Prevention. Take proactive approaches to manage all aquatic and terrestrial areas of the National Forest System in a manner to protect native species and ecosystems from the introduction, establishment, and spread of invasive species. Prevention can also include actions to design public-use facilities to reduce accidental spread of invasive species, and actions to educate and raise awareness with internal and external audiences about the invasive species threat and respective management solutions.

2. Early Detection and Rapid Response (EDRR). Inventory and survey susceptible aquatic and terrestrial areas of the National Forest System so as to quickly detect invasive species infestations, and subsequently implement immediate and specific actions to eradicate those infestations before they become established and/or spread. Coordinate detection and response activities with internal and external partners to achieve an effective EDRR approach across all aquatic and terrestrial areas of the National Forest System. EDRR actions are grouped into three main categories: early detection, rapid assessment, and rapid response. EDRR systems will be consistent with guidance from the National Invasive Species Council, such as the 'Guidelines for Early Detection and Rapid Response'.

3. Control and Management. Conducting integrated invasive species management activities on priority aquatic and terrestrial areas of the National Forest System will be consistent with guidance from the National Invasive Species Council, such as the 'Control and Management Guidelines', to contain, reduce, and remove established infestations of aquatic and terrestrial invasive species, and to limit the adverse effects of those infestations on native species, human health, and other National Forest System resources.

4. Restoration. Pro-actively manage aquatic and terrestrial areas of the National Forest System to increase the ability of those areas to be self-sustaining and resistant (resilience) to the

establishment of invasive species. Where necessary, implement restoration, rehabilitation, and/or revegetation activities following invasive species treatments to prevent or reduce the likelihood of the reoccurrence or spread of aquatic or terrestrial invasive species.

5. Organizational Collaboration. Cooperate with other Federal agencies, State agencies, local governments, tribes, academic institutions, and the private sector to increase public awareness of the invasive species threat, and promote a better understanding of integrated activities necessary to effectively manage aquatic and terrestrial invasive species throughout the National Forest System. Coordinate National Forest System invasive species management activities with other Forest Service programs and external partners to reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of aquatic and terrestrial invasive species. Coordinate and integrate invasive species research and technical assistance activities conducted by Forest Service Research and Development, and State and Private Forestry programs with National Forest System programs to increase the management effectiveness against aquatic and terrestrial invasive species infestations impacting or threatening the National Forest System.

Decision to be Made

The Beckwourth District Ranger is the Responsible Official for this project. The decision to be made is whether to treat the Rush Skeleton Weed infestation with herbicides. If the decision is made to treat with herbicide, it will specify the herbicides to use, when to apply them, and any project design criteria (including application of standards and guidelines as well as monitoring) to ensure that potential impact to natural resources are minimized. In addition to this decision, the Responsible Official will make a finding on the significance of the environmental effects anticipated from implementation of the selected action and whether an environmental impact statement (EIS) will need to be prepared. The responsible official expects to make a decision on this project in the fall of 2014. Implementation could begin the fall of 2014.

Public Involvement and Tribal Consultation

Notice of pending action first appeared in the Plumas National Forest quarterly Schedule of Proposed Actions (SOPA) as the Rush Skeleton Weed Project in March of 2014.

The National Environmental Policy Act (NEPA) scoping process started in 2014 with publication of the Proposed Action in the *Portola Reporter* and the *Feather River Bulletin* on March 12, 2014. A total of 28 scoping packets (Proposed Action, figures and maps) were sent to the adjacent landowners and to various individuals, organizations, government agencies and federally-recognized Native American Tribes with ancestral territory in or near the project area. The scoping period ended on March 26, 2013. One comment was received and it is included in the project record, available upon request.

Measurement indicators were created by each Forest Service interdisciplinary team member to analyze the direct, indirect, and cumulative effects to their resource by alternative. These analyses are described fully in the specialist reports (available in the Project Record) and are summarized in Chapter 3.

Chapter 2: Proposed Action and Alternatives

The Proposed Action and following alternatives were considered:

Alternative 1 – No-Action

Under this alternative the rush skeleton weed infestation in the project area would not be treated with herbicides. As explained in the following two paragraphs the existing infestation would be likely to spread.

Previously authorized hand treatment of the infestation would likely continue on an annual basis. Hand treatment would reduce the risk of spread but it is less effective than herbicide treatment because it does not kill plants. Hand treatment is less practical than herbicide treatment because it requires regular repeated visits to the site throughout the growing season to ensure that no plants produce mature seeds.

Activities proposed in the Discovery Mine may be implemented. That proposal is being evaluated in a separate process. If those activities are implemented without implementing the rush skeleton weed project there would be an increased risk of noxious weed spread and infestation. That risk includes creation of new infestations as well as an increase in size and density of the existing infestation.

Alternative 2 - Proposed Action

The Forest Service is proposing the actions listed below on identified National Forest System (NFS) lands within the Rush Skeleton Weed Project area to meet the Need for the Proposal, described above. This Proposed Action consists of, in general terms, the following three actions:

1. Mechanical removal of rush skeleton weed plants by hand pulling and digging with shovels.
2. Herbicide spraying of rush skeleton weed plants by licensed applicators using backpack sprayers while walking. Spray would be directed onto individual rush skeleton weed plants only and no broadcast spraying would be done.
3. Re-vegetation with native grasses and legume plant species would be done in areas of bare soil.

Following is a detailed description of the actions which include all applicable PNF LRMP, as amended (USDA 1988 and USDA 2004 a, b), Standards and Guidelines (S&Gs).

Two treatment methods are proposed: chemical and manual. They would both be used but at different times. The proposed action would treat rush skeleton weed on approximately 1.1 acres and would include identification and treatment of new or expanded infestations on a maximum of 42 acres. Treatments would continue for a maximum of 10 years.

Chemical Treatment

The proposal is to use formulations of the herbicide aminocyclopyrachlor + chlorsulfuron (e.g. Perspective™) or Aminopyralid + Triclopyr (e.g. Capstone™ or Milestone Plus®) in this project.

All rush skeleton weed plants would be sprayed with aminocyclopyrachlor + chlorsulfuron (e.g. Perspective™) or aminopyralid + triclopyr (e.g. Capstone™ or Milestone Plus®) or a combination of these herbicides. A surfactant (e.g. methylated seed oil) and a locating dye (e.g. Spymax) would be added to the herbicide. All herbicide application would be done with a backpack sprayer while walking. Application methods would include select, directed spray, or wicking. No aerial application or broadcast spraying of herbicides is proposed in this project. Treatment would occur two or three times per year. The first treatment would occur in rosette stage before any plants have produced viable seeds. Later treatments would be done in late-summer or early fall; new basal rosettes normally appear after the first rain of September or October and can be treated effectively at that time. The maximum application rates are shown in Table 1 below. The project area and the access routes would be searched prior to treatments and outer boundary of the infestation would be clearly marked.

Table 1. Herbicide Application rates.

Chemical Name	Application Rate
Aminocyclopyrachlor + Chlorsulfuron	4.75 to 8 oz./acre
Aminopyralid + Triclopyr	4 to 6 pints/acre

The following herbicides are proposed for treating invasive plants:

- Aminocyclopyrachlor + Chlorsulfuron (Perspective®): Perspective provides pre-emergence and/or post-emergence control of broadleaf weed species. A post-emergence application must be used for perennial weed species such as rush skeleton weed.
- Aminopyralid (trade names include Milestone®): This herbicide provides mainly post-emergence control of many annual, biennial, and perennial invasive plant species, including rush skeleton weed. It is selective and it does not injure grasses and many broadleaf species, though it can injure legumes (Fabaceae) and members of the sunflower family (Asteraceae). For some species, aminopyralid can provide residual (pre-emergence) control, thereby reducing the need for retreatment. Within the soil, aminopyralid does not persist for long (<2 weeks) and is relatively immobile.
- Triclopyr (trade names include GarlonTM 3A, Milestone VM Plus): This herbicide provides pre- and post-emergence control of woody and broadleaf plants and resprout control as stump treatment on woody plants. It is selective and has little impact on grasses. It can reside in soils for up to 6 months. Triclopyr can be used in combination with aminopyralid in a pre-mixed formulation (e.g. Milestone VM Plus).

Design criteria to protect human health, water quality, and natural resources will be incorporated into the proposed action. Herbicides would be applied in accordance with: 1) product label directions; 2) California Department of Pesticide Regulation requirements; 3) Forest Service best management practices for water quality (USDA Forest Service 2011); and 4) Forest Service direction (FSM 2900, 2150 and 2200) and Handbook (FSH 2109.14). This project will include a Pesticide Use Spill Plan. Prior to any herbicide use, a Pesticide Use Proposal (PUP)

(FS-2100-2) and safety plan (FS-6700-7) will be completed by the project leader and approved by the Responsible Official. These documents will be included in the project record.

Manual treatment

Treatment by hand-pulling, digging or tarping may be done at any time during the year, if necessary, to remove or kill plants that would not be promptly sprayed with herbicides.

Re-vegetation

Treatment areas would be re-vegetated with native grasses to provide competition with and prevent reestablishment of rush skeleton weed. Species proposed for rehabilitation of the project area include: mountain brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), and deer vetch (*Acmispon americanus* var. *americanus* formerly known as *Lotus purshianus*). Other native grass and forb species may be substituted for the aforementioned grasses depending on availability.

The Proposed Action is consistent with Best Management Practices (BMPs) to protect water quality as specified in the Pacific Southwest Region Water Quality Management Handbook (USDA 2011). Application of these BMPs is reflected in the Proposed Action's design features, resource management measures (mitigations), and monitoring strategy.

Mitigations

Mitigation measures have been developed to limit the potential for adverse effects associated with proposed activities.

- Proposed project design criteria also include implementation of soil and water Best Management Practices (BMPs)
- Include provisions for, "Cleaning of Equipment and Protection of Habitat of Sensitive Species" in contract provisions for improvements in the project area, such as culvert replacement or fence building that involve ground disturbance. Prevention/Cleaning: Require all off-road equipment and vehicles (Forest Service and contracted) used for project implementation to be weed-free. Clean all equipment and vehicles of all attached mud, dirt and plant parts. This will be done at a vehicle washing station or steam cleaning facility before the equipment and vehicles enter the project area. Cleaning is not required for vehicles that will stay on the roadway. Also, all off-road equipment must be cleaned prior to leaving areas infested with noxious weeds.
- For additional Threatened, Endangered, or Sensitive (TES) plant species found during the life of this project, an assessment would be done and management prescriptions applied.
- Prevention/Road Construction, Reconstruction, and Maintenance: All earth-moving equipment, gravel, fill, or other materials need to be weed free. Use onsite sand, gravel, rock, or organic matter where possible.

- Prevention/Staging Areas: Do not stage equipment, materials, or crews in noxious weed infested areas where there is a risk of spread to areas of low infestation.
- Small infestations identified during project implementation will be evaluated for treatment or "flagged and avoided," if practical, according to the species present and project constraints. If larger infestations are identified after implementation, they should be isolated and avoided with equipment (and equipment washed as above).
- A notification will be posted in the area that herbicides are sprayed to inform the public.

Monitoring Strategy

The monitoring strategy consists of both implementation monitoring and effectiveness monitoring, described below. Monitoring is an essential component of the adaptive management strategy described in Table 4, providing the means to assess whether management actions are effective in meeting specified goals and objectives.

Implementation Monitoring

Implementation monitoring would be conducted to ensure that the parameters of the decision are being implemented as described.

Effectiveness Monitoring

Effectiveness monitoring would be conducted to assess whether the project design criteria and mitigation measures are performing in achieving their intended effects. This monitoring would provide information on whether desired conditions are being met and whether trends are stable, improving, or declining. Effectiveness monitoring would occur at various time intervals depending on the goal of the monitoring as described below and in Appendix F. Monitoring would include: a count or an estimate of the number of surviving plants, a count or an estimate of number of plants killed as a result of treatment, a measures of the area of the infestation before and after each season of treatment using GPS.

Water quality monitoring is explained in detail in Appendix F.

Additional monitoring may be done if necessary to provide information that would be used to determine if management is moving resources toward desired conditions. Review of monitoring methodologies and results would be done with an interdisciplinary team.

Alternatives Eliminated From Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Possible reasons to eliminate a suggested alternative from detailed study include: failure to adequately meet the purpose and need, illegality, technologically infeasible, clearly unreasonable, duplication within the existing range, decision already made, unreasonable environmental harm, cannot be implemented, or remote or speculative.

Alternative 3 – Continued hand treatment without use of herbicides

This alternative is not likely to be effective at reducing the size and density of the known infestation or preventing its spread. It may be possible to prevent any of the rush skeleton weed plants from producing seed by hand pulling each plant. However, this method would require weekly visits and does not kill plants. Rush skeleton weed plants quickly regenerate from root fragments left in soil. Roots can be several feet long and it is extremely unlikely that an entire root could be removed by hand pulling or digging with shovels in the rocky soils at the site.

Alternative 4 – Other methods of weed treatments

Mowing, burning, tilling, goat grazing, and other biological treatment methods are unlikely to be effective reducing the size and density of the known infestation or preventing its spread (USDA 2012 Chondrilla field guide).

Comparison of Alternatives

Table 2 provides a summary of effects of implementing each alternative, focusing on activities and effects where differences can be distinguished quantitatively or qualitatively.

Table 2. Comparison of effects of the Proposed Action and No Action alternatives

Purpose and Need	Item to compare	Alternative 1 – No action	Alternative 2 – Proposed Action
Need 1. To prevent an increase in density and area of the existing infestation and the establishment of new infestations.	Size and density of existing infestation, number of infestations	A likely increase in density, size, and number of infestations.	A likely decrease in density, size, and number of infestations.
Need 2. To mitigate the effects of the Discovery Mine Project that is proposed at the site of the infestation. The actions proposed in the Discovery Mine Project are likely to increase the risk of spread and density of the existing infestation.	Risk of spread of infestation	Increased risk of spread.	Decreased risk of spread.

Chapter 3 Environmental Impacts of the Proposed Action and Alternatives

This section summarizes the potential impacts of the Proposed Action and alternatives for each impacted resource. Resources that were not impacted and therefore not further analyzed include: fire and fuels, range, and silviculture.

Direct and Indirect Effects

Direct effects are caused by the action and occur at the same place and time as the action. Indirect effects are caused by the action but occur later in time or further removed in distance, but are still reasonably foreseeable.

The environmental consequences presented in Chapter 3 address the impacts of actions proposed under each alternative. This effects analysis was done at the project level. Resource specialists reviewed each affected area proposed in the alternatives.

As described in Chapter 2, for ease of documentation and understanding, the effects of the alternatives are described separately for distinct actions. The combination of these distinct actions is then added to the on-going and reasonably foreseeable actions in the cumulative effects analysis. The distinct actions analyzed for each alternative are noxious weed treatments.

Cumulative Effects

According to the Council on Environmental Quality (CEQ) NEPA regulations, "cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR § 1508.7).

The cumulative effects analysis area varies according to the resource being analyzed. Past activities are considered part of the existing condition and are discussed in the "Affected Environment" and "Environmental Consequences" sections under each resource. Appendix D provides a list of present, on-going and reasonably foreseeable future actions that could potentially contribute to cumulative effects.

In order to understand the contribution of past actions to the cumulative effects of the Proposed Action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

The cumulative effects analysis, for each specialist's cumulative effects section, with the exception of the Water and Soil Resource Effects Assessment, does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the Proposed Action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Furthermore, focusing on the impacts of past human actions risks ignores the important residual effects of past natural events. These important past events may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions”.

Most of the specialists use the aforementioned cumulative effects analysis rationale, with the exception of the Water and Soil Resource Effects Assessment, where past actions over a 30-year period are used as an input to the Equivalent Roaded Acre analysis model. A list of past treatment types, year and acres are provided in a separate table.

Specialist Reports

Each section in this chapter provides a summary of project specific reports, assessments, and/or input prepared by Forest Service specialists, which are incorporated by reference into this EA. The following reports or memoranda are incorporated by reference: Rush Skeleton Weed Project Biological Assessment/Biological Evaluation (BA/BE) Terrestrial and Aquatic Wildlife, Rush Skeleton Weed Project Management Indicator Species (MIS) Report, Rush Skeleton Weed Project Migratory Bird Species Report, Rush Skeleton Weed Project Water and Soil Resource Effects Assessment, Rush Skeleton Weed Project Biological Evaluation for Threatened, Endangered, or Sensitive Plant Species, and Cultural Resource Compliance for the Environmental Analysis of the Rush Skeleton Weed Area Report. These reports or memoranda are part of the project record on file at the Beckwourth Ranger District at 23 Mohawk Rd, Blairsden, CA 96103. Copies of these reports are available upon request by contacting the Beckwourth Ranger District at (530) 836-2575.

Human Health Risk Assessment

Introduction

The treatments proposed under the Rush Skeleton Weed Project (the project) present some risks to human health and safety. The purpose of this risk assessment is to present a summary of the potential risks to human health from use of the proposed herbicide treatments.

The hazards associated with using aminocyclopyrachlor, chlorsulfuron, aminopyralid, and triclopyr have been determined through comprehensive reviews of available toxicological studies; these reviews, which are compiled in a group of risk assessments completed by Syracuse Environmental Research Associates (SERA) under contract with the Forest Service, are also incorporated by reference into this risk assessment. Copies of these risk assessments are included in the project record.

The proposed application rates for aminocyclopyrachlor, chlorsulfuron, aminopyralid, and triclopyr within the range analyzed in the most recent SERA risk assessments (SERA 2004, 2007, 2011, 2012). Consequently, this report includes those portions of the human health risk assessment that pertain to the proposed use of aminocyclopyrachlor, chlorsulfuron, aminopyralid, and triclopyr within the project area. The tables included in this assessment are a summary of calculations contained most recent and relevant SERA risk assessments (SERA 2004, 2007, 20011, 2012).

Table 3 Comparison of the Chemicals and Application Rates Proposed Under the Rush Skeleton Weed Project with those Analyzed Under the SERA Risk Assessments (SERA 2004, 2007b, 2011, 2012).

Chemical	Rush Skeleton Weed Project		SERA Risk Assessment	
	Lower Application Rate	Upper Application Rate	Lower Application Rate	Upper Application Rate
Aminopyralid	0.05 a.e. lbs/acre	0.075 a.e. lbs/acre	0.03 a.e. lbs/acre	0.11 a.e. lbs/acre
Triclopyr	0.5 a.e. lbs/acre	0.75 a.e. lbs/acre	0.04 a.e. lbs/acre	a.e. lbs/acre
Aminocyclopyrachlor	0.12 lbs a.e./acre	0.19 lbs a.e./acre	Not available	0.28 lbs a.e./acre
Chlorsulfuron	0.047 lbs a.i. /acre	0.08 lbs a.i./acre	Not available	0.056 lbs. a.i./acre

The application of aminocyclopyrachlor, chlorsulfuron, aminopyralid, and triclopyr, as proposed by the project, is expected to present a low risk to human health and safety. Based on the available information, the addition of the proposed surfactant and dye, would also pose a low risk to human health and safety. The incorporation of Best Management Practices (included in Appendix E) would also reduce the level of exposure and associated risk to the health and safety of workers and members of the general public.

Hazard Identification

A considerable body of information describing the hazards associated with using each of the proposed herbicides is contained in the risk assessments completed by SERA (SERA 2004, 2007, 20011, 2012) under contract to the Forest Service. All of these documents are incorporated by reference into this risk assessment. The following section includes relevant portions of the hazard analysis provided in the most recent SERA risk assessments (SERA 2004, 2007, 20011, 2012).

A note specific to impurities and metabolites - virtually no chemical synthesis yields a totally pure product. Technical grade herbicides, as with other technical grade products, undoubtedly contain some impurities. The U.S. Environmental Protection Agency (EPA) defines the term impurity as "…any substance…in a pesticide product other than an active ingredient or an inert ingredient, including un-reacted starting materials, side reaction products, contaminants, and degradation products" (40 CFR 158.153(d)). To some extent, concern for impurities in technical grade herbicides and fungicides is reduced by the fact that the existing toxicity studies on these herbicides and fungicides were conducted with the technical grade product. Thus, if toxic impurities are present in the technical grade product, they are likely to be encompassed by the available toxicity studies on the technical grade product. An exception to this general rule involves carcinogens, most of which are presumed to act by non-threshold mechanisms. Because of the non-threshold assumption, any amount of a carcinogen in an otherwise non-carcinogenic mixture is assumed to pose some carcinogenic risk.

As with contaminants, the potential effect of metabolites on a risk assessment is often encompassed by the available *in vivo* toxicity studies under the assumption that the toxicological consequences of metabolism in the species on which toxicity studies are available will be similar to those in the species of concern (human in this case). Uncertainties in this assumption are encompassed by using an uncertainty factor in deriving the reference dose (RfD) and may sometimes influence the selection of the study used to derive the RfD.

Unless otherwise specifically referenced, all of the information in the following sections was taken directly from the executive summary of the most recent SERA risk assessment (SERA 2004, 2007, 20011, 2012).

Aminocyclopyrachlor (Source: SERA 2012)

The only consistent signs of toxicity associated with aminocyclopyrachlor involve decreased body weight, decreased weight gain, decreased food consumption, and decreased food conversion efficiency. Decreased body weight or weight gain accompanied by a decrease in food consumption can be secondary to other toxic effects (i.e., severely poisoned animals will often decrease their food consumption, which in turn leads to decreases in body weight and/or body weight gain). This pattern does not appear to be the case with aminocyclopyrachlor. Aminocyclopyrachlor does not cause other signs of toxicity which might be associated with decreased food consumption. Decreased food conversion efficiency may be but is not necessarily associated with changes in endocrine function; however, the mechanism by which aminocyclopyrachlor causes decreased food conversion efficiency has not been identified. The available subchronic and chronic toxicity studies do not report histopathological changes in endocrine tissues.

Based on standard acute oral toxicity studies, the LD50 of aminocyclopyrachlor cannot be determined—i.e., doses of up to 5000 mg/kg bw do not cause mortality or signs of toxicity in rats. The dose of 5000 mg/kg bw is a limit dose, a term used to designate the highest dose typically used in acute oral toxicity studies of pesticides. No remarkable signs of toxicity are reported in standard toxicity studies involving dermal, ocular, or inhalation exposure. Inhalation studies are available only on technical grade aminocyclopyrachlor. For all other routes of exposure, studies are available on technical grade aminocyclopyrachlor as well as DuPont™ Method® 240SL and DuPont™ Method® 50SG formulations. Technical grade aminocyclopyrachlor and DuPont™ Method® 50SG cause a somewhat greater degree of eye irritation, compared with DuPont™ Method® 240SL. The relatively modest differences may be due to the fact that technical grade aminocyclopyrachlor and DuPont™ Method® 50SG were tested as a powder; whereas, the DuPont™ Method® 240SL formulation is and was tested as a liquid. It is not uncommon for powders to cause modest levels of eye irritation due to general particulate exposure rather than specific toxicity.

The only reservation with the largely benign hazard identification for aminocyclopyrachlor involves the nature of the available data. Virtually all of the available information on the toxicity of aminocyclopyrachlor and aminocyclopyrachlor formulations to mammals comes from standard studies submitted to the U.S. EPA/OPP in support of the registration of aminocyclopyrachlor, and these studies are considered proprietary. DuPont™ (the sole registrant for aminocyclopyrachlor) provided copies of some full studies as well as OECD study summaries along with several U.S. EPA/OPP reviews (i.e., Data Evaluation Records). While these studies appear to be appropriately designed and conducted and were, with few exceptions, accepted by the U.S. EPA/OPP, the available information on aminocyclopyrachlor is much less diverse than the information available on some other herbicides (e.g., glyphosate and triclopyr) for which the open literature is rich and varied.

Chlorsulfuron (SERA 2004)

In experimental mammals, the acute oral LD50 for chlorsulfuron is greater than 5000 mg/kg, which indicates a low order of toxicity. Acute exposure studies of chlorsulfuron and chlorsulfuron formulations give similar results, indicating that formulations of chlorsulfuron are not more toxic than chlorsulfuron alone. The most common signs of acute, subchronic, and chronic toxicity are weight loss and decreased body weight gain. The only other commonly noted effects are changes in various hematological parameters and general gross pathological changes to several organs. None of these changes, however, suggest clear or specific target organ toxicity. Appropriate tests have provided no evidence that chlorsulfuron presents any reproductive risks or causes malformations or cancer. Results of all mutagenicity tests on chlorsulfuron are negative. The inhalation toxicity of chlorsulfuron is not well documented in the literature. Results of a single acute inhalation study indicate that chlorsulfuron produces local irritant effects. Chlorsulfuron is mildly irritating to the eyes and skin, but does not produce sensitizing effects following repeated dermal exposure.

Limited information is available on the toxicokinetics of chlorsulfuron. The kinetics of absorption of chlorsulfuron following dermal, oral or inhalation exposure are not documented in the available literature. Chlorsulfuron does not appear to concentrate or be retained in tissues following either single or multiple dose administration. Chlorsulfuron exhibits first order elimination kinetics, with an estimated half-life in rats of < 6 hours. In all mammalian species studied, chlorsulfuron and its metabolites are extensively and rapidly cleared by a combination of excretion and metabolism. The primary excretory compartment for chlorsulfuron and its metabolites is the urine, with smaller amounts excreted in the feces. Most of the chlorsulfuron excreted in urine is in the form of the parent compound. Studies on the toxicity of chlorsulfuron metabolites have not been conducted.

As discussed in the exposure assessment, skin absorption is the primary route of exposure for workers. Data regarding the dermal absorption kinetics of chlorsulfuron are not available in the published or unpublished literature. For this risk assessment, estimates of dermal absorption rates – both zero order and first order – are based on quantitative structure-activity relationships. These estimates of dermal absorption rates are used in turn to estimate the amounts of chlorsulfuron that might be absorbed by workers, which then are used with the available dose response data to characterize risk. The lack of experimental data regarding dermal absorption of chlorsulfuron adds substantial uncertainties to this risk assessment. Uncertainties in the rates of dermal absorption, although they are substantial, can be estimated quantitatively and are incorporated in the human health exposure assessment.

Aminopyralid (Source: SERA 2007)

Because aminopyralid is a new herbicide, no information is available in the published literature on the toxicity of aminopyralid to humans or other mammalian species. The only information on aminopyralid that is available for assessing potential hazards in humans is a series of toxicity studies that have been submitted to and evaluated by the U.S. EPA's Office of Pesticides in support of the registration for aminopyralid.

Although the mechanism of action of aminopyralid and other pyridine carboxylic acid herbicides is fairly well characterized in plants, the mechanism of action of aminopyralid in mammals is not well characterized. The weight-of-evidence suggests that aminopyralid may not have any remarkable systemic toxic effects. The effects that are most commonly seen involve effects on the gastrointestinal tract after oral exposure and these may be viewed as portal of entry effects rather than systemic toxic effects. The location of these effects within the gastrointestinal tract appears to vary among species with the ceca being the most common site of action in rats and the stomach being the most common site of action in dogs and rabbits. Mice do not seem to display any remarkable gastrointestinal effects after oral doses of aminopyralid. The reason for these differences among species is not clear but may simply reflect differences in methods of exposure (gavage versus dietary) and/or differences in anatomy.

In one acute oral toxicity study in rats using the aminopyralid TIPA (triisopropanolamine) formulation, lacrimation and cloudy eyes were noted in all test animals on the first day of the study but not on subsequent days. Clouding of the eyes is an unusual effect that has not been noted in other studies on aminopyralid. The significance of this observation, if any, is unclear.

Aminopyralid is rapidly absorbed and excreted and is not substantially metabolized in mammals. As a consequence of rapid absorption and excretion, gavage and dietary exposures probably lead to very different patterns in the time-course of distribution in mammals. The oral LD_{50} of aminopyralid has not been determined because aminopyralid does not cause any mortality at the dose limits set by the U.S. EPA for acute oral toxicity studies – i.e. up to 5,000 mg/kg bw. Similarly, subchronic and chronic toxicity studies have failed to demonstrate any clear signs of systemic toxic effects. Developmental studies involving gavage administration, however, have noted signs of incoordination in adult female rabbits. The incoordination was rapidly reversible and did not persist past the day of dosing. Two chronic oral bioassays have been conducted, one in mice and the other in rats, and a 1-year feeding study is available in dogs. Based on the results of the chronic bioassays as well as the lack of mutagenic activity in several mutagenicity screening assays, there is no basis for asserting that aminopyralid is a carcinogen. Similarly, based on the chronic bioassays and several additional subchronic bioassays in mice, rats, dogs, and rabbits, there is no basis for asserting that aminopyralid will cause adverse effects on the immune system or endocrine function. The potential for effects on the nervous system is less clear. Aminopyralid has also been subject to several bioassays for developmental toxicity and one multi-generation study for reproductive performance. No adverse effects on offspring have been noted in these studies other than decreased body weight in offspring that is associated with decreased food consumption and decreased body weight in adult females.

Triclopyr (Source: SERA 2011)

The toxicity of triclopyr to mammals is relatively well characterized in numerous standard acute, subchronic, and chronic toxicity studies as well as developmental and reproduction studies required by the U.S. EPA/OPP for pesticide registration. In mammals, the toxicity studies that yield the most sensitive endpoints—i.e., the signs of toxicity that occur at the lowest doses—for triclopyr involve developmental and reproductive effects. For both developmental and reproductive effects, however, adverse effects on offspring, most of which are indicative of delayed growth rather than frank abnormalities, occur at doses associated with maternal toxicity.

Based on histopathology and clinical chemistry data from standard acute, subchronic and chronic toxicity studies on triclopyr, the liver and kidneys are the primary target organs. Like most weak acids, triclopyr is excreted primarily in the kidney by an active transport process. At very high doses, this process may become saturated causing triclopyr to reach toxic levels. At sufficiently high doses, triclopyr may cause toxic effects, including death. Nonetheless, triclopyr has a low order of acute lethal potency. There is no information suggesting that triclopyr causes direct adverse effects on the nervous system, endocrine system, or immune function.

Standard bioassays for carcinogenicity were conducted in both rats and mice. In male rats and mice, no statistically significant dose-related trends in tumor incidence were apparent. Based on pair-wise comparisons (i.e., control group vs an exposed group), statistically significant increases were observed for some tumor types, including benign and/or malignant pheochromocytomas combined as well as skin fibromas, in rats but not mice. In female rats and mice, there was a statistically significant dose-related increase in mammary gland adenocarcinomas. The U.S. EPA/OPP reviewed these studies and determined that the evidence for carcinogenicity is marginal and did not recommend a quantitative dose-response assessment for the carcinogenicity of triclopyr. The current risk assessment defers to this decision.

The major metabolite of triclopyr in both mammals and the environment is 3,5,6-trichloro-2-pyridinol, commonly abbreviated as TCP. Although TCP does not have the phytotoxic potency of triclopyr, this compound is toxic to mammals as well as other species. Based on RfDs derived by the U.S. EPA/OPP, TCP is more toxic than triclopyr to mammals, and as discussed further in the ecological risk assessment, it is also more toxic than triclopyr to aquatic animals. Consequently, exposures to TCP and its toxicity are considered explicitly in the current risk assessment.

Exposure Assessment

Exposure scenarios are developed for workers and members of the general public. For each group, two types of exposure scenarios are generally taken into consideration: general exposure and accidental/incidental exposure.

The term general exposure refers to human exposure resulting from the normal use of the chemical. For workers, general exposure involves the handling and application of the compound. These general exposure scenarios can be interpreted relatively easily and objectively. The exposure estimates are calculated from the amount of the chemical handled/day and the exposure rates for the worker group. Although each of the specific exposure assessments for workers involves degrees of uncertainty, the exposure estimates are objective in that they are based on empirical relationships of absorbed dose to pesticide use. For the general public the general exposure scenarios are somewhat more arbitrary and may be less plausible. For each pesticide, at least three general exposure scenarios are considered, including walking through a contaminated area shortly after treatment, the consumption of ambient water from a contaminated watershed, and the consumption of contaminated vegetation. These three scenarios are consistently used because one of them usually leads to the highest estimates of exposure. Additional scenarios discussed below may be considered for each of the individual compounds as warranted by the available data and the nature of the program activities.

Some, if not all, of these general exposure scenarios for the general public may seem implausible or at least extremely conservative. For example, in many cases compounds are applied in relatively remote areas and so it is not likely that members of the general public would be exposed to plants shortly after treatment. Similarly, the estimates of longer-term consumption of contaminated water are based on estimated application rates and monitoring studies that can be used to relate levels in ambient water to treatment rates in a watershed; however, in most pesticide applications, substantial portions of a watershed are not likely to be treated. Finally, the exposure scenarios based on longer-term consumption of contaminated vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by an individual over a 90-day period. While such inadvertent contamination might occur, it is extremely unlikely to happen as a result of directed applications (e.g., backpack applications). Even in the case of boom spray operations, the spray is directed at target vegetation and the possibility of inadvertent contamination of cultivated or edible vegetation would be low. In addition, for herbicides and other phytotoxic compounds, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed.

All of the factors discussed above concerning general exposure scenarios for the general public have merit and must be considered in the interpretation of the risk characterization. Thus, the typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the general public, the general exposures may be regarded as extreme in that they are based on very conservative exposure assessments and/or very implausible events. Nonetheless, these general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public, and to provide estimates regarding the likelihood and nature of effects after human exposure to pesticides.

Accidental/incidental exposure scenarios describe specific examples of gross over-exposure associated with mischance or mishandling of a chemical. All of these exposure scenarios are arbitrary in that the nature and duration of the exposure is fixed. For example, the worker exposure scenario involving immersion of the hands is based on a 1-minute period of exposure but could just as easily be based on an exposure period of 5 seconds or 5 minutes. Similarly, the consequences of wearing contaminated gloves could be evaluated at 4 hours rather than at 1 hour. These scenarios are intended to provide an indication of relative hazard among different pesticides and different events in a manner that facilitates conversion or extrapolation to other exposure conditions.

Like the general exposure scenarios, the accidental exposures for the general public may be regarded as more extreme than those for workers. Three scenarios are included in each exposure assessment. They include direct spray, the consumption of contaminated water shortly after a spill, and the consumption of contaminated vegetation shortly after treatment. The direct spray scenario is clearly extreme. It assumes that a naked child is sprayed directly with a pesticide as it is being applied and that no steps are taken to remove the pesticide from the child for 1 hour. There are no reports of such incidents in the literature, and the likelihood of such an incident occurring appears to be remote. Nonetheless, this scenario and others like it are useful not only as a uniform comparison among pesticides but also as a simplifying step in the risk assessment. If the 'naked child' scenario indicates no basis for concern, other dermal spray scenarios will not suggest a potential hazard and need not be explored. If there is a potential hazard, other more plausible exposure scenarios may need to be considered. The other two accidental scenarios are similarly intended to serve as uniform comparisons among chemicals as well as a means of evaluating the need to explore additional exposure scenarios.

Typically, the level of exposure is directly proportional to the exposure parameters. The exposure associated with wearing gloves for 4 hours is 4 times the exposure associated with wearing contaminated gloves for 1 hour. Similarly, the general exposure scenarios for workers are based on an 8-hour work day. If a 4-hour application period were used, the hazard indices would be reduced by a factor of two. As another example, general exposure scenarios for both workers and the general public are linearly related to the application rate. Consequently, if the application rate were to double or vary by some other factor, the estimated exposure would double or vary by the same factor. Thus, the specific exposure parameters used in the risk assessment are selected to allow for relatively simple extrapolation to greater or lesser degrees of exposure.

Additional variability is taken into consideration by estimating exposure doses or absorbed doses for individuals of different age groups (i.e., adults, young children, toddlers, and infants). Children may behave in ways that increase their exposure to applied pesticides (e.g., long periods of outdoor play, pica, or imprudent consumption of contaminated media or materials). In addition, anatomical and physiological factors, such as body surface area, and breathing rates and consumption rates for food and water, are not linearly related to body weight and age. Consequently, the models used to estimate the exposure dose (e.g., mg/kg body weight/day) based on chemical concentrations in environmental media (e.g., ppm in air, water, or food) indicate that children, compared with individuals of different age groups, are generally exposed to the highest doses of chemicals for a given environmental concentration.

Workers

Pesticide applicators are the individuals who are most likely to be exposed to a pesticide during the application process. For purpose of this analysis, two different types of worker exposure assessments were considered: general and accidental/incidental. General exposure scenarios were used to analyze exposure resulting from normal use (i.e. handling and application) of the chemicals (SERA 2007b). Accidental and incidental exposure scenarios were used to analyze specific types of exposures associated with mischance or mishandling of a chemical (SERA 2007b).

The USDA Forest Service has generally used an absorption-based model for worker exposure modeling, in which the amount of chemical absorbed is estimated from the amount of chemical handled. Absorption based models have been used by the USDA Forest Service because of two common observations from field studies. First, most studies that attempt to differentiate occupational exposure by route of exposure indicate that dermal exposure is the dominant route of exposure for pesticide workers. Second, most studies of pesticide exposure that monitored both dermal deposition and chemical absorption or some other method of bio-monitoring noted a very poor correlation between the two values (e.g., Cowell et al. 1991, Franklin et al. 1981, Lavy et al. 1982, referenced in SERA 2007b). In this exposure assessment for workers, the primary goal is to estimate the absorbed dose so that the absorbed dose estimate can be compared with available information on the dose-response relationships for the chemical of concern.

Although pesticide application involves many different job activities, exposure rates can be defined for three broad categories: directed application such as those involving the use of backpacks or similar devices; broadcast hydraulic spray applications; and broadcast aerial applications. The method proposed for control of noxious weeds and the project (i.e. backpack spraying) falls under the category of direct application; therefore only the risks associated with this job activity will be presented in this risk analysis.

Exposure rates for workers are calculated using a number of factors that include: proposed application rates, dilution rates, estimated hours worked per day, number of acres treated per hour and human dermal absorption rates. As described in SERA (2007b), worker exposure rates are expressed in units of milligrams (mg) of absorbed dose per kilogram (kg) of body weight per pound of chemical handled (mg/kg/lb applied). A summary of the exposure scenarios calculated for workers is provided in the tables at the end of this section.

General Exposure

*the full table is available in the project folder

Table 6, 5, 6 and 7 display the exposure rates calculated for a scenario involving general exposure to aminocyclopyrachlor, chlorsulfuron, aminopyralid, and triclopyr. This scenario represents the type of exposure that might be expected to occur over the course of each work day during a prolonged application program.

Accidental and Incidental Exposures

Typical occupational exposures may involve multiple routes of exposure (i.e., oral, dermal, and inhalation); nonetheless, dermal exposure is generally the predominant route for herbicide applicators. Typical multi-route exposures are encompassed by the methods used in general exposures. Accidental exposures, on the other hand, are most likely to involve splashing a solution of herbicide into the eyes or to involve various dermal exposure scenarios.

The available literature does not include quantitative methods for characterizing exposure or responses associated with splashing a solution of a chemical into the eyes; furthermore, there appear to be no reasonable approaches to modeling this type of exposure scenario quantitatively. Consequently, accidental exposure scenarios of this type are considered qualitatively in the risk characterization.

There are various methods for estimating absorbed doses associated with accidental dermal exposure. Two general types of exposure are modeled: those involving direct contact with a solution of the herbicide and those associated with accidental spills of the herbicide onto the surface of the skin. Any number of specific exposure scenarios could be developed for direct contact or accidental spills by varying the amount or concentration of the chemical on or in contact with the surface of the skin and by varying the surface area of the skin that is contaminated.

Exposure scenarios involving direct contact with solutions of the chemical are characterized by immersion of the hands for one minute or wearing contaminated gloves for one hour. Generally, it is not reasonable to assume or postulate that the hands or any other part of a worker will be immersed in a solution of an herbicide for any period of time. On the other hand, contamination of gloves or other clothing is quite plausible. For these exposure scenarios, the key element is the assumption that wearing gloves grossly contaminated with a chemical solution is equivalent to immersing the hands in a solution. In either case, the concentration of the chemical in solution that is in contact with the surface of the skin and the resulting dermal absorption rate are essentially constant.

Exposure scenarios involving chemical spills on to the skin are characterized by a spill on to the lower legs as well as a spill on to the hands. In these scenarios, it is assumed that a solution of the chemical is spilled onto a given surface area of skin and that a certain amount of the chemical adheres to the skin. The absorbed dose is then calculated as the product of the amount of the chemical on the surface of the skin (i.e., the amount of liquid per unit surface area multiplied by the surface area of the skin over which the spill occurs and the concentration of the chemical in the liquid) the first-order absorption rate, and the duration of exposure. For both scenarios, it is assumed that the contaminated skin is effectively cleaned after one hour. As with the exposure assessments based on Fick's first law, this product (mg of absorbed dose) is divided by bodyweight (kg) to yield an estimated dose in units of mg chemical/kg body weight. The specific equation used in these exposure assessments is taken from SERA (2007b).

Summary of Worker Exposures

The following tables provide a summary of the general and accidental exposure scenarios calculated for workers.

Table 4. Summary of Worker Exposure Scenarios – Aminocyclopyrachlor at the maximum proposed application rate of 0.19 lbs. a.e./acre*

Scenario	Central Dose (mg/kg/day)	Lower Range (mg/kg/day)	Upper Range (mg/kg/day)
General Exposure (dose in mg/kg/day)			
Backpack application	0.00249375	0.0000855	0.0152
Accidental/Incidental Exposures (dose in mg/kg/event)			
Contaminated Gloves, 1 minute	0.000000352	4.902E-09	0.000002806
Contaminated Gloves, 1 hour	0.00002112	2.9412E-07	0.00016836
Spill on hands,1 hour	5.48977E-05	6.01887E-07	0.000551311
Spill on lower legs,1 hour	0.000135284	1.48322E-06	0.001358587

*the full table is available in the project folder

Table 5. Summary of Worker Exposure Scenarios – Chlorsulfuron at the Maximum Proposed Application Rate of 0.08 lb. a.i./acre

Scenario	Central Dose (mg/kg/day)	Lower Range (mg/kg/day)	Upper Range (mg/kg/day)
General Exposure (dose in mg/kg/day)			
Backpack application	0.00105	0.000036	0.0064
Accidental/Incidental Exposures (dose in mg/kg/event)			
Contaminated Gloves, 1 minute	2.208E-07	5.056E-09	1.3248E-06
Contaminated Gloves, 1 hour	0.000013248	3.0336E-07	0.000079488
Spill on hands,1 hour	8.29365E-06	1.07518E-07	8.29067E-05
Spill on lower legs,1 hour	2.04379E-05	2.64955E-07	0.000204306

*the full table is available in the project folder

Table 6 Summary of Worker Exposure Scenarios for Aminopyralid Applied at the Maximum Application Rate of 0.075 lb a.e. /acre

Scenario	Typical Dose (mg/kg/day)	Lower Range (mg/kg/day)	Upper Range (mg/kg/day)
General Exposure (dose in mg/kg/day)			
Backpack application	0.000984375	0.00003375	0.006
Accidental/Incidental Exposures (dose in mg/kg/event)			
Contaminated Gloves, 1 minute	1.6911×10^{-7}	2.02739×10^{-8}	3.52673×10^{-6}
Contaminated Gloves, 1 hour	1.01469×10^{-5}	1.21643×10^{-6}	0.000211604
Spill on hands,1 hour	3.97947×10^{-5}	3.70424×10^{-6}	0.001067915
Spill on lower legs,1 hour	9.80656×10^{-5}	9.12829×10^{-6}	0.002631648

*the full table is available in the project folder

Table 7 Summary of Worker Exposure Scenarios for Triclopyr Applied at the Maximum Application Rate of 0.75 lb a.e /acre

Scenario	Typical Dose (mg/kg/day)	Lower Range (mg/kg/day)	Upper Range (mg/kg/day)
General Exposure (dose in mg/kg/day)			

Backpack application	0.00984375	0.0003375	0.06
Accidental/Incidental Exposures (dose in mg/kg/event)			
Contaminated Gloves, 1 minute	0.00001728	0.00000484	0.0001944
Contaminated Gloves, 1 hour	0.0010368	0.002904	0.011664
Spill on hands,1 hour	0.000303994	6.33505×10^{-5}	0.004486964
Spill on lower legs,1 hour	0.000749129	0.000156114	0.011057162

*the full table is available in the project folder

General Public

Under normal conditions, members of the general public should not be exposed to substantial levels of aminocyclopyrachlor, chlorsulfuron, aminopyralid, or triclopyr. Nonetheless, exposure scenarios can be constructed for the general public, depending on various assumptions regarding application rates, dispersion, canopy interception, and human activity. Several highly conservative scenarios are utilized to characterize this risk.

The two types of exposure scenarios developed for the general public include acute exposure and longer-term or chronic exposure. All of the acute exposure scenarios are primarily accidental. They assume that an individual is exposed to the compound either during or shortly after its application. Specific scenarios are developed for direct spray, dermal contact with contaminated vegetation, and consumption of contaminated fruit, vegetation, water, and fish. Most of these scenarios should be regarded as extreme, some to the point of limited plausibility (SERA 2007b). The longer-term or chronic exposure scenarios parallel the acute exposure scenarios for the consumption of contaminated fruit, vegetation, water, and fish but are based on estimated levels of exposure for longer periods after application. A summary of the exposure scenarios calculated for workers is provided in the tables at the end of this section.

Direct Spray

Direct sprays involving ground applications are modeled in a manner similar to accidental spills for workers. In other words, it is assumed that the individual is sprayed with a solution containing the compound and that an amount of the compound remains on the skin and is absorbed by first-order kinetics. As with the worker exposure scenarios, the first-order absorption kinetics are estimated from the empirical relationship of first-order absorption rate coefficients to molecular weight and octanol-water partition coefficients (SERA 2007b).

For direct spray scenarios, it is assumed that during a ground application, a naked child is sprayed directly with the herbicide. The scenario also assumes that the child is completely covered (that is, 100 percent of the surface area of the body is exposed), which makes this an extremely conservative exposure scenario that is likely to represent the upper limits of plausible exposure. An additional set of scenarios are included involving a young woman who is accidentally sprayed over the feet and legs. For each of these scenarios, some standard assumptions are made regarding the surface area of the skin and body weight.

Dermal Exposure from Contaminated Vegetation

In this exposure scenario, it is assumed that the herbicide is sprayed at a given application rate and that an individual comes in contact with sprayed vegetation or other contaminated surfaces at some period after the spray operation. For these exposure scenarios, some estimates of dislodgeable residue and the rate of transfer from the contaminated vegetation to the surface of the skin must be available. When no such data are directly available for these herbicides the estimation methods of Durkin et al. (SERA 2007b) are used. Other estimates used in this exposure scenario involve estimates of body weight, skin surface area, and first-order dermal absorption rates.

Contaminated Water

Water can be contaminated from runoff, as a result of leaching from contaminated soil, from a direct spill, or from unintentional contamination from applications. For this risk assessment, the two types of estimates made for the concentration of these herbicides in ambient water are acute/accidental exposure from an accidental spill and longer-term exposure to the herbicides in ambient water that could be associated with the typical application of these compounds to a 100-acre treatment area.

The acute exposure scenario assumes that a young child (2- to 3-years old) consumes one liter (L) of contaminated water (a range of 0.6 to 1.5 L) shortly after an accidental spill of 200 gallons of a field solution into a pond that has an average depth of 1 meter and a surface area of 1000 square meters or about one-quarter acre. Because this scenario is based on the assumption that exposure occurs shortly after the spill, no dissipation or degradation of the herbicide is considered. This is an extremely conservative scenario dominated by arbitrary variability. The actual concentrations in the water would depend heavily on the amount of compound spilled, the size of the water body into which it is spilled, the time at which water consumption occurs relative to the time of the spill, and the amount of contaminated water that is consumed. It is also unlikely that ponds would be the water body receiving any herbicides in this project. Flowing streams are the more likely recipients, so dilution would occur.

The scenario for chronic exposure to these herbicides from contaminated water assumes that an adult (70 kg male) consumes contaminated ambient water for a lifetime. There are some monitoring studies available on these herbicides (i.e. glyphosate) that allow for an estimation of expected concentrations in ambient water associated with ground applications of the compound over a wide area. However, for others (i.e. aminopyralid), such monitoring data does not exist. For those herbicides without monitoring data, for this component of the exposure assessment, estimates of levels in ambient water were made based on the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model.

GLEAMS is a root zone model that can be used to examine the fate of chemicals in various types of soils under different meteorological and hydro-geological conditions (SERA 2007b). SERA (2004) illustrated the general application of the GLEAMS model to estimating concentrations in ambient water. The results of the GLEAMS modeling runs are displayed in the respective SERA risk assessments. It is important to note that water monitoring conducted in the Pacific Southwest Region since 1991 involving glyphosate (USDA 2001) has shown that the assumptions in this risk assessment (in terms of water contamination) provide for a conservative (i.e. protective) assessment of risk.

Oral Exposure from Contaminated Fish

Many chemicals may be concentrated or partitioned from water into the tissues of animals or plants in the water. This process is referred to as bio-concentration. Generally, bio-concentration is measured as the ratio of the concentration in the organism to the concentration in the water. For example, if the concentration in the organism is 5 mg/kg and the concentration in the water is 1 mg/L, the bio-concentration factor (BCF) is 5 L/kg. As with most absorption processes, bio-concentration depends initially on the duration of exposure but eventually reaches steady state. Details regarding the relationship of bio-concentration factor to standard pharmacokinetic principles are provided in Calabrese and Baldwin (1993, referenced in SERA 2007b).

Both of the herbicides in this risk assessment have BCF values for fish of one or less. These values are generally determined from a standardized test that is required as part of the registration process.

For both the acute and longer-term exposure scenarios involving the consumption of contaminated fish, the water concentrations of the herbicides used are identical to the concentrations used in the contaminated water scenarios. The acute exposure scenario is based on the assumption that an adult angler consumes fish taken from contaminated water shortly after an accidental spill of 200 gallons of a field solution into a pond that has an average depth of one meter and a surface area of 1,000 square meters or about one-quarter acre. No dissipation or degradation is considered. Because of the available and well-documented information and substantial differences in the amount of caught fish consumed by the general public and Native American subsistence populations (U.S. EPA 1996, referenced in SERA 2007b), separate exposure estimates are made for these two groups. The chronic exposure scenario is constructed in a similar way.

Oral Exposure from Contaminated Vegetation

Under normal circumstances and in most types of applications, it is extremely unlikely that humans will consume, or otherwise place in their mouths, vegetation contaminated with the proposed herbicides. Nonetheless, any number of scenarios could be developed involving either accidental spraying of edible wild vegetation, like berries, or the spraying of plants collected by Native Americans for basket weaving or medicinal use. Again, in most instances and particularly for longer-term scenarios, treated vegetation would probably show signs of damage from herbicide exposure, thereby reducing the likelihood of consumption that would lead to significant levels of human exposure. Notwithstanding that assertion, it is conceivable that individuals could consume contaminated vegetation.

One of the more plausible scenarios involves the consumption of contaminated berries after treatment along a road or some other area in which wild berries grow. The two accidental exposure scenarios developed for this exposure assessment include one scenario for acute exposure and one scenario for longer-term exposure. In both scenarios, the concentration of herbicide on contaminated vegetation is estimated using the empirical relationships between application rate and concentration on vegetation developed by (Hoerger and Kenaga 1972, referenced in SERA 2007b). For the acute exposure scenario, the estimated residue level is taken as the product of the application rate and the residue rate. For the longer-term exposure scenario a duration of 90 days is used and the dissipation on the vegetation is estimated based on the estimated or established foliar half-times.

Although the duration of exposure of 90 days may appear to be somewhat arbitrarily chosen, it is intended to represent the consumption of contaminated vegetation that might be available over one season. Longer durations could be used for certain kinds of vegetation but would lower the estimated dose (i.e., would result in a less conservative exposure assessment). The central estimate of dose for the longer-term exposure period is taken as the time-weighted average of the initial concentration and concentration after 90 days. For the acute exposure scenario, it is assumed that a woman consumes one pound (0.4536 kg) of contaminated fruit. Based on statistics summarized in EPA (1996, referenced in SERA 2007b), this consumption rate is approximately the mid-range between the mean and upper 95 percent confidence interval for the total vegetable intake for a 64 kilogram woman. The longer-term exposure scenario is constructed in a similar way, except that the estimated exposures include the range of vegetable consumption (U.S. EPA 1996, referenced in SERA 2007b) as well as the range of concentrations on vegetation and the range of application rates for the herbicides.

Summary of General Public Exposures

The following tables provide a summary of the exposure scenarios calculated for members of the general public.

Table 8 Summary of General Public Scenarios for Aminocyclopyrachlor Applied at the Maximum Proposed Application Rate of 0.19 lb a.e./acre

Scenario	Receptor	Central	Lower	Upper
Accidental Acute Exposures (dose in mg/kg/event)				
Direct Spray of child, whole body	Child	2.07×10^{-3}	2.27×10^{-5}	2.08×10^{-2}
Direct Spray of woman, feet and lower legs	Adult Female	2.08×10^{-4}	2.28×10^{-6}	2.09×10^{-3}
Water consumption (spill)	Child	3.13×10^{-2}	1.98×10^{-4}	1.96×10^{-1}
Fish consumption (spill)	Adult Male	2.97×10^{-3}	3.08×10^{-5}	1.24×10^{-2}
Fish consumption (spill)	Subsistence Population	1.45×10^{-2}	1.50×10^{-4}	6.06×10^{-2}
Non-Accidental Acute Exposures (dose in mg/kg/event)				
Vegetation Contact, shorts and T-shirt	Adult Female	2.14×10^{-4}	4.54×10^{-5}	1.00×10^{-3}
Contaminated Fruit	Adult Female	2.23×10^{-3}	1.02×10^{-3}	3.55×10^{-2}
Contaminated Vegetation	Adult Female	3.08×10^{-2}	2.14×10^{-3}	2.57×10^{-1}
Swimming, one hour	Adult Female	8.03×10^{-9}	4.31×10^{-11}	2.14×10^{-7}
Water consumption	Child	1.43×10^{-3}	1.74×10^{-5}	1.50×10^{-2}
Fish consumption	Adult Male	1.36×10^{-4}	2.71×10^{-6}	9.49×10^{-4}
Fish consumption	Subsistence Population	6.61×10^{-4}	1.32×10^{-5}	4.63×10^{-3}
Chronic/Longer Term Exposures (dose in mg/kg/day)				
Contaminated Fruit	Adult Female	1.63×10^{-3}	7.44×10^{-4}	2.58×10^{-2}
Contaminated Vegetation	Adult Female	2.24×10^{-2}	1.56×10^{-3}	1.87×10^{-1}
Water Consumption	Adult Male	3.26×10^{-4}	3.42×10^{-6}	2.28×10^{-3}

Fish Consumption	Adult Male	5.15×10^{-6}	7.72×10^{-8}	3.00×10^{-5}
Fish Consumption	Subsistence Population	4.17×10^{-5}	6.26×10^{-7}	2.43×10^{-4}

Table 9 Summary of General Public Exposure Scenarios – Chlorsulfuron Applied at the Maximum Application Rate of 0.08 lb a.i./acre

Scenario	Receptor	Central	Lower	Upper
Acute Accidental Exposures (dose in mg/kg/event)				
Direct Spray of Child, whole body	Child	3.13×10^{-4}	4.06×10^{-6}	3.13×10^{-3}
Direct Spray of woman, feet and lower legs	Adult Female	3.15×10^{-5}	4.08×10^{-7}	3.15×10^{-4}
Water consumption (spill)	Child	1.37×10^{-2}	1.11×10^{-4}	8.02×10^{-2}
Fish consumption (spill)	Adult Male	4.10×10^{-4}	5.47×10^{-6}	1.64×10^{-3}
Fish consumption (spill)	Subsistence Population	2.00×10^{-3}	2.66×10^{-5}	7.99×10^{-3}
Non-Accidental Acute Exposures (dose in mg/kg/event)				
Vegetation Contact, shorts and T-shirt	Adult Female	2.89×10^{-5}	5.63×10^{-6}	1.43×10^{-4}
Contaminated Fruit	Adult Female	9.41×10^{-4}	4.30×10^{-4}	1.49×10^{-2}
Contaminated Vegetation	Adult Female	1.30×10^{-2}	9.00×10^{-4}	1.08×10^{-1}
Swimming, one hour	Adult Female	4.86×10^{-9}	1.67×10^{-10}	2.92×10^{-8}
Water consumption	Child	6.02×10^{-4}	3.67×10^{-5}	1.80×10^{-3}
Fish consumption	Adult Male	1.81×10^{-5}	1.81×10^{-6}	3.61×10^{-6}
Fish consumption	Subsistence Population	8.80×10^{-5}	8.80×10^{-6}	1.76×10^{-4}
Chronic/Longer Term Exposures (dose in mg/kg/day)				
Contaminated Fruit	Adult Female	3.96×10^{-4}	1.81×10^{-4}	6.28×10^{-3}
Contaminated Vegetation	Adult Female	5.45×10^{-3}	3.79×10^{-4}	4.54×10^{-2}
Water Consumption	Adult Male	1.37×10^{-6}	1.60×10^{-7}	2.47×10^{-6}
Fish Consumption	Adult Male	1.03×10^{-8}	1.71×10^{-9}	1.54×10^{-8}
Fish Consumption	Subsistence Population	8.33×10^{-8}	1.39×10^{-8}	1.25×10^{-7}

Table 10 Summary of General Public Scenarios for Aminopyralid Applied at the Maximum Application Rate of 0.075 lb a.e./acre

Scenario	Receptor	Central	Lower	Upper
Accidental Acute Exposures (dose in mg/kg/event)				
Direct Spray of child, whole body	Child	1.50×10^{-3}	1.40×10^{-4}	4.03×10^{-2}
Direct Spray of woman, feet and lower legs	Adult Female	1.51×10^{-4}	1.41×10^{-5}	4.05×10^{-3}
Water consumption (spill)	Child	2.56×10^{-2}	1.56×10^{-3}	3.84×10^{-1}
Fish consumption (spill)	Adult Male	7.69×10^{-4}	7.69×10^{-5}	7.69×10^{-3}
Fish consumption (spill)	Subsistence Population	3.75×10^{-3}	3.75×10^{-4}	3.75×10^{-2}
Non-Accidental Acute Exposures (dose in mg/kg/event)				

Vegetation Contact, shorts and T-shirt	Adult Female	6.87×10^{-5}	1.29×10^{-5}	3.61×10^{-4}
Contaminated Fruit	Adult Female	8.82×10^{-4}	4.03×10^{-4}	1.40×10^{-2}
Contaminated Vegetation	Adult Female	1.22×10^{-2}	8.44×10^{-4}	1.01×10^{-1}
Swimming, one hour	Adult Female	1.86×10^{-9}	8.92×10^{-12}	4.66×10^{-8}
Water consumption	Child	5.64×10^{-4}	6.88×10^{-6}	5.08×10^{-3}
Fish consumption	Adult Male	1.69×10^{-5}	3.39×10^{-7}	1.02×10^{-4}
Fish consumption	Subsistence Population	8.25×10^{-5}	1.65×10^{-6}	4.95×10^{-4}
Chronic/Longer Term Exposures (dose in mg/kg/day)				
Contaminated Fruit	Adult Female	1.88×10^{-4}	6.77×10^{-5}	3.58×10^{-3}
Contaminated Vegetation	Adult Female	2.59×10^{-3}	1.42×10^{-4}	2.59×10^{-2}
Water Consumption	Adult Male	8.57×10^{-5}	1.50×10^{-6}	6.69×10^{-4}
Fish Consumption	Adult Male	4.29×10^{-7}	1.07×10^{-8}	2.79×10^{-6}
Fish Consumption	Subsistence Population	3.47×10^{-6}	8.68×10^{-8}	2.26×10^{-5}

Table 11 Summary of General Public Scenarios for Triclopyr Applied at the Maximum Application Rate of 0.75 lb a.e./acre

Scenario	Receptor	Central	Lower	Upper
Accidental Acute Exposures (dose in mg/kg/event)				
Direct Spray of child, whole body	Child	1.15×10^{-2}	2.39×10^{-3}	1.70×10^{-1}
Direct Spray of woman, feet and lower legs	Adult Female	1.15×10^{-3}	2.40×10^{-4}	1.70×10^{-2}
Water consumption (spill)	Child	1.02×10^{-1}	7.64×10^{-3}	1.54
Fish consumption (spill)	Adult Male	1.85×10^{-4}	2.26×10^{-5}	1.85×10^{-3}
Fish consumption (spill)	Subsistence Population	8.99×10^{-4}	1.10×10^{-4}	8.99×10^{-3}
Non-Accidental Acute Exposures (dose in mg/kg/event)				
Vegetation Contact, shorts and T-shirt	Adult Female	1.61×10^{-3}	5.52×10^{-4}	4.65×10^{-3}
Contaminated Fruit	Adult Female	8.82×10^{-3}	4.03×10^{-3}	1.40×10^{-1}
Contaminated Vegetation	Adult Female	1.22×10^{-1}	8.44×10^{-3}	1.01
Swimming, one hour	Adult Female	1.43×10^{-8}	2.18×10^{-12}	2.57×10^{-6}
Water consumption	Child	1.69×10^{-4}	3.44×10^{-8}	2.03×10^{-2}
Fish consumption	Adult Male	3.05×10^{-7}	1.02×10^{-10}	2.44×10^{-5}
Fish consumption	Subsistence Population	1.49×10^{-6}	4.95×10^{-10}	1.19×10^{-4}
Chronic/Longer Term Exposures (dose in mg/kg/day)				
Contaminated Fruit	Adult Female	3.43×10^{-3}	1.04×10^{-3}	9.41×10^{-2}
Contaminated Vegetation	Adult Female	1.21×10^{-2}	3.52×10^{-4}	2.80×10^{-1}
Water Consumption	Adult Male	2.14×10^{-5}	3.00×10^{-12}	1.54×10^{-3}
Fish Consumption	Adult Male	6.43×10^{-9}	1.29×10^{-15}	3.86×10^{-7}
Fish Consumption	Subsistence Population	5.21×10^{-8}	1.04×10^{-14}	3.12×10^{-6}

Dose Response Assessment

The purpose of this section is to describe the degree or severity of risk as a function of dose (SERA 2007b). In general, dose-response assessments use reference doses (RfD), or dose levels associated with a negligible or defined level of risk, as indices of "acceptable exposure" (SERA 2007b). Table 12 provides a summary of the established reference doses (RfD) for aminopyralid. In this table, RfD values are derived for both acute exposures (i.e. those occurring within a short time frame) as well as chronic exposures (i.e. long-term exposures).

Table 12 Summary of the Reference Doses (RfD) Established for the two Proposed Herbicides. (SERA 2004, 2007, 2011, 2012).

Chemical	Reference Dose (RfD)	
	Acute (mg/kg bw)	Chronic (mg/kg bw/day)[a]
Aminocyclopyrachlor	3.5	0.35
Cyclopropanecarboxylic acid	0.0026	0.00087
Chlorsulfuron	0.25	0.02
Aminopyralid	1	0.5
Triclopyr	1	0.05

[a] mg/kg/day = milligrams of agent per kilogram of body weight per day.

The following sections contain relevant excerpts from the dose response assessment contained within the SERA risk assessments for aminocyclopyrachlor, chlorsulfuron, aminopyralid, and triclopyr (SERA 2004, 2007a, 2011, 2012). Unless otherwise specifically referenced, all of the information in the following sections was taken directly from the executive summary of the most recent SERA risk assessments (SERA 2004, 2007a, 2011, 2012).

Aminocyclopyrachlor (Source: SERA 2012)

The dose-response assessment considers both aminocyclopyrachlor and cyclopropanecarboxylic acid. As discussed in Section 3.1.15.1, U.S. EPA/OPP (2010a) identifies cyclopropanecarboxylic acid as a degradate of concern, and this compound is considered quantitatively in the current risk assessment. An overview of the dose-response assessments for aminocyclopyrachlor is given in Table 11, and an overview for the dose-response assessment for cyclopropanecarboxylic acid is given in Table 12. For aminocyclopyrachlor, the current Forest Service risk assessment uses an acute 10 RfD of 3.5 mg/kg bw/day and a chronic RfD of 0.35 mg/kg bw/day. For cyclopropanecarboxylic acid, the acute RfD is taken as 0.0026 mg/kg bw and the chronic RfD is taken as 0.00087 mg/kg bw/day. These RfDs are currently used by and derived by the EPA (U.S. EPA/OPP 2010a). The standard practice used in Forest Service risk assessments is to defer to U.S. EPA in the selection and derivation of RfDs. Aminocyclopyrachlor is a new herbicide under conditional registration, and the RfDs for aminocyclopyrachlor and cyclopropanecarboxylic acid may be revised by the U.S. EPA in the near future. New registrant studies for both aminocyclopyrachlor and cyclopropanecarboxylic acid were submitted to the U.S. EPA/OPP, and these studies may lead to changes in the RfDs for aminocyclopyrachlor and cyclopropanecarboxylic acid. The description of the new studies and their likely impact on the RfDs are discussed in Section 3.3.2 for aminocyclopyrachlor and 22 Section 3.3.3 of SERA (2012) for cyclopropanecarboxylic acid. If the EPA changes the RfDs for either or both compounds, the revised RfDs will be adopted in the current risk assessment. If the EPA revises the RfDs subsequent to the completion of this Forest Service risk assessment, the Forest Service may elect to use the newer RfDs in any application of this risk assessment to Forest Service projects or programs.

The U.S. EPA/OPP will sometimes derive acute RfDs for pesticides. Typically, acute RfDs are based on developmental studies, under the assumption that the endpoint observed in the developmental study could be associated with a single dose of the pesticide. For aminocyclopyrachlor, however, the EPA did not derive an acute RfD because no acute end-point of concern was identified (U.S. EPA/OPP 2010a, p. 30). Weight loss is the only effect attributable to aminocyclopyrachlor in developmental studies. Weight loss is generally associated with several days of exposure and not typically used by the U.S. 36 EPA/OPP to derive an acute RfD.

The U.S. EPA/OPP (2010a, Table 3.3.10.1, p. 22) does, however, derive an RfD for Incidental Oral Short-Term exposures. This RfD is intended to apply to exposure periods of 1 to 30 days. This short-term RfD is based on the 13-week feeding study in rats by Anand (2008a,b) in which decreases in body weight, weight gain, food consumption, and food conversion efficiency were observed at a dietary concentration of 18,000 ppm in both males and females. These effects were not observed at a dietary concentration of 6000 ppm. The rat NOAEL of 6000 ppm is supported by subchronic NOAELs in mice (7000 ppm, Anand 2008c,d) and dogs (15,000, 1 Luckett 2008a; Luckett and Mawn 2008).

In deriving the short-term RfD, U.S. EPA/OPP 6 (2010a) uses a NOAEL dose of 350 mg/kg bw/day. The NOAEL is divided by an uncertainty factor of 100 (i.e., a factor of 10 to account for sensitive individuals multiplied by the factor of 10 to account for inter-species extrapolation). Thus, the short-term RfD is taken as 3.5 mg/kg bw/day. This RfD is used in the current risk assessment to characterize the consequences of accidental and other acute exposures to aminocyclopyrachlor.

The U.S. EPA has not derived an agency-wide chronic RfD for aminocyclopyrachlor —i.e., there is no RfD for aminocyclopyrachlor listed on the U.S. EPA Integrated Risk Information System (http://www.epa.gov/IRIS/). Other than the chronic RfD from U.S. EPA/OPP (2010a) discussed below, no exposure criteria were identified for aminocyclopyrachlor.

Chronic studies were completed in dogs (Han 2010), mice (Huh 2010), and rats (Moon 2010); however, these studies were not available at the time that the conditional registration for aminocyclopyrachlor (U.S. EPA/OPP 2010k) was approved. In the absence of chronic studies, U.S. EPA/OPP (2010a, Section 3.3.2, p. 19) uses the subchronic rat NOAEL of 350 mg/kg bw/day from Anand (2008c, d). Rather than applying an uncertainty factor of 100 as was done with the short-term RfD, U.S. EPA/OPP (2010a) uses an uncertainty factor of 1000, with the additional factor of 10 accounting for extrapolation of a subchronic to chronic study. Thus, the EPA derived a chronic RfD is 0.35 mg/kg bw/day (U.S. EPA/OPP 2010a).

As summarized in SERA 2012, Table A-1, the 2-year feeding study in rats results in a NOAEL of 6000 ppm with a LOAEL (based on a decrease in food conversion efficiency and body weight parameters) of 18,000 ppm. These dietary NOAEL and LOAEL values are identical to the corresponding subchronic value in rats from the study by Anand (2008a,b). Based on measured food consumption and body weights, the corresponding chronic doses are somewhat lower than subchronic doses. The chronic NOAEL of 6000 ppm corresponds to an average dose of about 270 mg/kg bw/day in male rats and 309 mg/kg bw/day in female rats. The chronic LOAEL of 18,000 ppm corresponds to an average dose of about 892 mg/kg bw/day in male rats and 957 mg/kg bw/day in female rats. Like the subchronic NOAEL in rats, the chronic NOAEL in rats is supported by dietary NOAELs of 30,000 ppm in mice (Han 2010) and 7000 ppm in dogs (Huh 37 2010).

If the U.S. EPA/OPP reviews and accepts the newly submitted chronic studies, it is likely the chronic RfD for aminocyclopyrachlor will be revised to about 3 mg/kg bw/day (i.e., the rat NOAEL of 270 mg/kg bw divided by an uncertainty factor of 100 and rounded to one significant digit).

For the current Forest Service risk assessment, the current chronic RfD of 0.35 mg/kg bw/day is used for risk characterization, in keeping with the practice in Forest Service risk assessments of deferring to RfDs derived by the U.S. EPA unless there is a compelling reason to do otherwise. In the case of the chronic RfD for aminocyclopyrachlor, the summaries of the chronic studies given in SERA 2012 (Table A1-2) are based on OECD study summaries rather than the full studies. In addition, without their review and acceptance by U.S. EPA/OPP, the newly submitted chronic studies would not be used to derive a new RfD for aminocyclopyrachlor unless the data suggested that the current EPA RfD is not sufficiently protective, which is not the case.

Table 13 Aminocyclopyrachlor, Human Health Dose-Response Assessment

Duration	Derivation of RfD	Reference	Comment
Acute – single exposure			
NOAEL Dose		N N/A S.	The U.S. EPA/OPP (2010a) did not derive an acute RfD for aminocyclopyrachlor. No acute endpoint was identified because no toxicity was observed at the limit dose in acute oral studies. (U.S. EPA/OPP 2010a, p. 19)
LOAEL Dose			
LOAEL Endpoint(s)			
Species, sex			
Uncertainty Factor		E EPA/OPP 2010a	
RfD	None derived		
Chronic – lifetime exposure			
NOAEL Dose	350 mg/kg bw/day	A Anand 2008a M MRID 47573403 A Anand 2008b MRID 47560007	This chronic RfD was derived for the conditional registration of aminocyclopyrachlor (U.S. EAA/OPP 2012k). Sind the conditional registration was issued, chronic studies on aminocyclopyrachlor have submitted to the U. S. EPA/OPP – i.e. Han 2010. It is likely that the RfD will increase at some point.
LOAEL Dose	1045 mg/kg bw/day		
Species, sex	Rats, male and female		
LOAEL Endpoint(s)	Decreased body weight, weight gain, food consumption, and food efficiency		
Uncertainty Factor	1000	U.S.EPA/OPP 2010a	
RfD	3.5 mg/kg bw/day		

Incidental Oral Exposure (Short- and Intermediate-Term)			
NOAEL Dose	350 mg/kg bw/day	Anand 2008a MRIS 47573403	In the absence of an acute RfD, this toxicity value is used in the current Forest Service risk assessment to characterize risks associated with acute exposures.
LOAEL Dose	1045 mg/kg bw/day		
LOAEL Endpoint	Decreased body weight, weight gain, food consumption, and food efficiency.	Anand 2008b MRIS 47560007	
Species, sex	Rats, male and female		
Uncertainty Factor/MOE	100	U.S.EPA/OPP 2010a	
Equivalent RfD	3.5 mg/kg bw/day		

Cyclopropanecarboxylic acid

U.S. EPA/OPP (2010a) identifies cyclopropanecarboxylic acid, a degradate of Aminocyclopyrachlor, as a degradate of concern.

The acute RfD for cyclopropanecarboxylic acid is somewhat atypical in that the RfD is based on a gavage study of panadiplon in rabbits (Ulrich et al. 1995). As discussed in Section 3.1.15.1, (SERA 2012) the EPA converted the LOAEL of 10 mg panadiplon/kg bw/day to a LOAEL of 2.55 mg cyclopropanecarboxylic acid/kg bw/day based solely on differences in the molecular weights of the two compounds (U.S. EPA/OPP 2010a). In deriving the acute RfD for cyclopropanecarboxylic acid, the EPA used an uncertainty factor of 1000 (i.e., a multiple of 10 20 for sensitive subgroups, for animal-to-human extrapolation, and 10 for extrapolating from the LOAEL to a NOAEL) and rounded the acute RfD to two significant places (i.e., 0.0026 mg/kg 22 bw/day.

As discussed previously in Section 3.1.15.1, (SERA 2012) DuPont™ recently completed a 90-day gavage study with cyclopropanecarboxylic acid in rats in which no effects were noted at doses of 2 and 10 mg/kg bw/day (Carpenter 2012). As yet, an EPA review of the Carpenter (2012) study is not available. Although the EPA would not use the Carpenter (2012) study directly to modify the acute (single-dose) RfD, the study may be useful for developing a short-term (1 to 30 day exposure) RfD, similar to the approach taken for aminocyclopyrachlor. Taking this approach, the EPA would probably use an uncertainty factor of 100 (i.e., a multiple of 10 for species extrapolation and a factor of 10 for sensitive subgroups), and the modified acute/incidental RfD would be 0.1 mg/kg bw.

Following standard practice in Forest Service risk assessments, the current acute RfD of 0.0026 mg/kg bw/day from U.S. EPA/OPP (2010a) is used to characterize risks associated with acute exposure scenarios.

The chronic RfD for cyclopropanecarboxylic acid derived by U.S. EPA/OPP is 0.00087 mg/kg bw/day (U.S. EPA/OPP 2010a). Like the acute RfD, the chronic RfD is based on the gavage study of panadiplon in rabbits (Ulrich et al. 1995). As discussed in Section 3.3.3.1 (SERA 2012), the cyclopropanecarboxylic acid equivalent LOAEL of 2.55 mg/kg bw/day is divided by a factor of 3000 (i.e., a multiple of the three factors described for the acute RfD and an additional factor of 3 for extrapolating from a subchronic to a chronic value).

This chronic RfD is highly atypical. The Ulrich et al. (1995) study involves an exposure period of only 10 days. U.S. EPA/OPPTS (2000) recognizes 28-day studies as a screening assay for standard 90-day subchronic studies. Although 10-day periods of exposure are sometimes used in acute dietary toxicity studies in mammals, a duration of 10 days is not generally viewed as a standard exposure duration for a subchronic study. This atypical exposure duration raises concern that the use of the Ulrich et al. (1995) study may not be sufficiently protective.

Conversely and as discussed in Section 3.3.3.1(SERA 2012) , DuPont™ recently completed a gavage 90-day study in rats in which no effects were observed at doses of 2 and 10 mg/kg bw/day (Carpenter 2012). U.S. EPA/OPP might, if the study is judged acceptable, consider using the NOAEL of 10 mg/kg bw/day to derive an alternate chronic RfD. Following standard practice, the EPA would probably use an uncertainty factor of 1000 (i.e., a multiple of 10 for sensitive subgroups, 10 for animal-to-human extrapolation, and 10 for extrapolating from subchronic to chronic exposure), and the revised RfD would be 0.01 mg/kg bw/day. The only substantial reservation with this approach is whether rats or rabbits are considered the most sensitive species.

As with the acute RfD , the current Forest Service risk assessment uses chronic RfD of 0.00087 mg/kg bw/day derived by U.S. EPA/OPP (2010a) to characterize risks associated with chronic exposures to cyclopropanecarboxylic acid. Uncertainties regarding the possibility that the U.S. EPA/OPP might revise the chronic RfD for cyclopropanecarboxylic acid are discussed further in the risk characterization section.

Table 14 Cyclopropanecarboxylic acid, Human Health Dose-Response Assessment

Duration	Derivation of RfD	Reference	Comment
Acute – single exposure			
NOAEL Dose	Not determined	Ulrich et al. 1994	Toxicity study on panadiplon. Dose equivalent of 2.55 mg/kg bw/day calculated based on molar conversion of 10 mg/kg bw/day x 14 days dose of panadiplon. Standard uncertainty factors.
LOAEL Dose	2.55 mg/kg bw/day		
LOAEL Endpoint(s)	Hepatic steatosis		
Species, sex	Rabbits		
Uncertainty Factor	1000	U.S. EPA/OPP 2010a	
RfD	0.0026 mg/kg/day		
Chronic – lifetime exposure			
NOAEL Dose	Not determined	Ulrich et al. 1994	EPA used only a 3x uncertainty factor for extrapolating from a 14 day exposure to a chronic exposure.
LOAEL Dose	2.55 mg/kg bw/day		
Species, sex	Rabbits		
LOAEL Endpoint(s)	Hepatic steatosis		
Uncertainty Factor	3000	U.S. EPA/OPP 2010a	
RfD	0.00087 mg/kg bw/day		

Chlorsulfuron (Source: SERA 2004)

The U.S. EPA derived a chronic RfD for chlorsulfuron of 0.05 mg/kg/day. This RfD is currently listed on the U.S. EPA IRIS web site. This RfD is based on a two-year rat feeding study. The rats were given chlorsulfuron in the diet at concentrations of 100, 500 and 2,500 ppm for two years. Treatment related adverse effects of decreases in mean body weights and weight in male rats occurred at the 500 ppm and 2,500 ppm dose level. No frank signs of toxicity were seen at the 100 ppm or higher dose levels. Dose related effects on various hematological parameters were observed in males; however, these effects were observed during the first year. The investigators indicated that although the findings suggest the presence of reticulocytosis, reticulocyte counts were not measured. Consequently, the investigators concluded that in the absence of clarifying data, the biological significance of these hematological effects is unclear. No other behavioral, nutritional, clinical, hematological, gross, or histopathological abnormalities were observed. In deriving the RfD, the U.S EPA accepted the 100 ppm dose as a NOAEL and estimated the daily intake as 5 mg/kg/day and used an uncertainty factor of 100.

The U.S. EPA Office of Pesticide Programs has recently proposed a lower chronic RfD of 0.02 mg/kg/day, which appears to be based on the identical study used by U.S. EPA in deriving the RfD of 0.05 mg/kg/day. The difference in the two RfDs is accounted for by an additional uncertainty factor required under the FQPA. Citing a three-generation reproduction study in which effects "...considered of questionable toxicological significance..." were noted at 125 mg/kg/day, the U.S. EPA selected an FQPA uncertainty factor of 3. Thus, the chronic NOAEL of 5 mg/kg/day was divided by 300 – factors of 10 for extrapolating from animals to humans, 10 for extrapolating to sensitive individuals within the human population, and 3 for accounting for differences in children as required by FQPA. This value was rounded to one significant decimal to yield the RfD of 0.02 mg/kg/day. For this risk assessment, the lower and more recent RfD of 0.02 mg/kg/day will be used to characterize all risks involving chronic or longer-term exposures.

The NOAEL of 5 mg/kg/day for chronic toxic effects is below the NOAEL of 25 mg/kg/day for reproductive effects. Thus, doses at or below the RfD will be below the level of concern for reproductive effects.

The U.S. EPA did not explicitly derive an acute/single dose RfD for chlorsulfuron. Nonetheless, for several short-term exposure scenarios the U.S. EPA recommends that an acute RfD be 0.25 mg/kg/day. This acute RfD appears to be based on a developmental study in rabbits with decreased body weight gains at 200 mg/kg/day. As with the chronic RfD, the NOAEL of 75 mg/kg/day was divided by an uncertainty factor of 300. Consistent with U.S. EPA, this risk assessment will use the short term RfD of 0.25 mg/kg/day to characterize all risks acute or short-term exposures.

Aminopyralid (Source: SERA 2007a)

The Office of Pesticide Programs of the U.S. EPA has derived a chronic RfD of 0.5 mg/kg/day for aminopyralid. This RfD is based on a chronic rat NOAEL [No Observed Adverse Effect Level] of 50 mg/kg/day and an uncertainty factor of 100. The Office of Pesticide Programs has also derived an acute RfD of 1 mg/kg bw/day based on a NOAEL from a reproduction study of about 100 mg/kg/day. In deriving both of these RfD values, the U.S. EPA used an uncertainty factor of 100, a factor of 10 for extrapolating from animals to humans and a factor of 10 for extrapolating to sensitive individuals within the human population. Both of these RfD values are based on NOAELs for the most sensitive endpoint in the most sensitive species and studies in which LOAEL values were identified. In addition, both of the NOAEL values are supported by other studies. Thus, the RfD values recommended by the U.S. EPA are adopted directly in the current risk assessment.

The human health risk assessment prepared by the U.S. EPA (U.S. EPA/OPP-HED 2005) proposes a chronic RfD of 0.5 mg a.e./kg bw/day for the general population. This chronic RfD is based on a NOAEL of 50 mg a.e./kg/day from the 24-month feeding study in rats.

The RfD of 0.5 mg a.e./kg/day was derived by dividing the NOAEL of 50 mg a.e./kg bw/day by an uncertainty factor of 100. This uncertainty factor consists of two components: a factor of 10 for extrapolating from animals to humans and a factor of 10 for extrapolating to sensitive individuals within the human population. Using the same conversion factor, the 500 mg a.e./kg bw/day dose corresponds to an estimated functional human LOAEL of 5 mg a.e./kg/day. At this functional LOAEL, moderately adverse effects might be anticipated.

The NOAEL of 50 mg a.e./kg bw/day in rats used by the U.S. EPA to derive the chronic RfD is supported by the chronic NOAEL of 50 mg a.e./kg bw/day in mice (Stebbins and Day 2003b) as well as the chronic NOAEL in dogs of about 100 mg a.e./kg bw/day (Stebbins and Day 2003a). Thus, the U.S. EPA has selected the most sensitive endpoint for the most sensitive species and the chronic RfD developed by the U.S. EPA will be used directly in the current risk assessment.

The risks associated with longer-term exposures between the RfD of 0.5 mg a.e./kg bw/day and the functional LOAEL of 5 mg a.e./kg/day cannot be characterized. While this range of indeterminate dose is relatively large – i.e., a factor of 10 – this has no impact on the current risk assessment. As discussed further in Section 3.4.2 (SERA 2011), all of the estimated longer-term exposures to aminopyralid are substantially below the chronic RfD.

For incidental (short-term and intermediate exposures), the U.S. EPA has proposed and RfD of 1.0 mg a.e./kg bw/day or incident. No adverse effects that could be associated with treatment were noted the dose of 104 mg a.e./kg bw/day and this dose was accepted by the U.S. EPA as a NOAEL. The selection of 104 mg a.e./kg bw/day as a NOEAL appears to be appropriate. As noted in SERA 2011, a case could be made for selecting the dose of 260 mg a.e./kg bw/day as a NOEAL. Using the higher NOAEL value, however, would not properly consider the biological significance of the effects or the dose/response relationship.

The NOAEL of 104 mg a.e./kg bw/day is support by several other acceptable developmental studies in rabbits (Marty et al. 2002; Liberacki et al. 2001b) and rats (Carney and Tornesi 2001; Bjorn 2003; Tornesi et al. 2001) in that all of these studies report NOAELs of greater than 104 mg a.e./kg bw/day and none of these studies report any effects at or below 104 mg a.e./kg bw/day.

Following standard practice in Forest Service risk assessments, the acute RfD of 1 mg a.e/kg bw/day derived by the U.S. EPA will be adopted in this risk assessment.

As with the chronic RfD, the acute RfD of 1 mg a.e/kg bw/day or incident is derived by dividing the acute NOAEL of 100 mg/kg bw/day by an uncertainty factor of 100, the rational for which is the same as in the chronic RfD. Taking the acute dose of 260 mg a.e./kg bw/day as a minimal acute LOAEL and using the uncertainty factor of 100, the functional human acute LOAEL is estimated at 2.6 mg/kg/day. At this functional LOAEL, moderately adverse effects might be anticipated in human exposures.

Triclopyr (Source: SERA 2011)

Generally, the dose-response assessments used in Forest Service risk assessments adopt RfDs proposed by the U.S. EPA as indices of 'acceptable' exposure. An RfD is basically defined as a level of exposure that will not result in any adverse effects in any individual. The U.S. EPA RfDs are used because they generally provide a level of analysis, review, and resources that far exceed those that are or can be conducted in the support of most Forest Service risk assessments. In addition, it is desirable for different agencies and organizations within the federal government to use concordant risk assessment values.

In the Re-registration Eligibility Decision (RED) on triclopyr, the U.S. EPA recommends a chronic RfD of 0.05 mg/kg/day. This chronic RfD is based on a two-generation reproduction study in rats in which degeneration of renal proximal tubules were noted in adult animals at a dose of 25 mg/kg/day but not at 5 mg/kg/day. The 24 mg/kg/day NOAEL dose was divided by 100, a factor of 10 to account for uncertainties in species-to-species extrapolation and another factor of 10 to encompass sensitive individuals in the population. Thus, the resulting RfD is 0.05 mg/kg/day. U.S. EPA/OPP maintains this RfD in the most current pesticide tolerances and applies it to several intermediate exposure scenarios—i.e., exposure periods of 1-6 months.

The most recent RfD on triclopyr is that proposed by the U.S. EPA Office of Pesticide Programs. This RfD of 1 mg/kg/day for the general population was proposed originally in the RED for triclopyr. This RfD is based on the NOAEL of 100 mg/kg/day in a study in which rats were administered doses of triclopyr BEE. Maternal toxicity was observed at 300 mg/kg/day. The NOAEL for fetal toxicity, however, was 100 mg/kg bw/day. The EPA uses this NOAEL to derive an acute RfD of 1 mg/kg bw/day. Furthermore, the EPA indicates that the acute RfD is not applicable to females between the ages of 13-50 years—i.e., of child bearing age. The basis for this recommendation appears to be signs of maternal toxicity observed at 30 mg/kg bw/day with the NOAEL of 5 mg/kg bw/day. As discussed above, the chronic RfD for triclopyr is 0.05 mg/kg bw/day, based on a NOAEL of 5 mg/kg bw/day. Thus, for women of childbearing age, the U.S. EPA/OPP recommends an acute RfD of 0.05 mg/kg/day, equivalent to the chronic RfD. Under the Food Quality Protection Act (FQPA), the U.S. EPA is required to evaluate whether or not an additional uncertainty factor is required for the protection of children. Because of the concordance of the acute NOAEL based on a developmental study and the chronic NOAEL based on the reproduction study, the EPA determined that no additional FQPA uncertainty factor is required.

Risk Assessment

An overview of risks to workers is given in Table 14. Similar overviews for risks to members of the general public are given in Table 15. In these tables, risk is characterized as the hazard quotient (HQ), the estimated level of exposure divided by an acute or chronic RfD depending on the exposure scenario. The level of concern is defined as an HQ of 1 or greater.

The following section presents a quantitative summary of the risk to workers and members of the general public associated with exposure to aminocyclopyrachlor, chlorsulfuron, aminopyralid, and triclopyr. This assessment utilizes the specific chemicals, and maximum application rates proposed for control of rush skeleton weed in the project.

Risk characterization is a process that compares doses that people may get from applying pesticides (i.e. workers) or from being near an application site (i.e. members of the general public) with the U.S. Environmental Protection Agency's established Reference Doses (RfD), a level of exposure considered protective of lifetime or chronic exposures. Risk characterization is expressed as a hazard quotient; a hazard quotient of one or less indicates that the likelihood of adverse effects are low (SERA 2006).

As with any risk assessment: absolute safety cannot be proven and the absence of risk can never be demonstrated. No chemical has been studied for all possible effects and the use of data from laboratory animals to estimate hazard or the lack of hazard to humans is a process that contains uncertainty. Prudence dictates that normal and reasonable care should be taken in the handling of these chemicals.

Table 15 Hazard Quotients for the General Public from Exposure to Aminocyclopyrachlor.

Scenario	Receptor	Central	Lower	Upper
Accidental Acute Exposures				
Direct Spray of child, whole body	Child	6.0×10^{-4}	6.0×10^{-6}	6.0×10^{-3}
Direct Spray of woman, feet and lower legs	Adult Female	6.0×10^{-5}	7.0×10^{-7}	6.0×10^{-4}
Water consumption (spill)	Child	9.0×10^{-3}	6.0×10^{-5}	6.0×10^{-2}
Fish consumption (spill)	Adult Male	8.0×10^{-4}	9.0×10^{-6}	4.0×10^{-3}
Fish consumption (spill)	Subsistence Population	4.0×10^{-3}	4.0×10^{-5}	2.0×10^{-2}
Non-Accidental Acute Exposures				
Vegetation Contact, shorts and T-shirt	Adult Female	6.0×10^{-5}	1.0×10^{-5}	3.0×10^{-4}
Contaminated Fruit	Adult Female	6.0×10^{-4}	3.0×10^{-4}	1.0×10^{-2}
Contaminated Vegetation	Adult Female	9.0×10^{-3}	6.0×10^{-4}	7.0×10^{-2}
Swimming, one hour	Adult Female	2.0×10^{-9}	1.0×10^{-11}	6.0×10^{-8}
Water consumption	Child	4.0×10^{-4}	5.0×10^{-6}	4.0×10^{-3}
Fish consumption	Adult Male	4.0×10^{-5}	8×10^{-7}	3×10^{-4}
Fish consumption	Subsistence Population	2.0×10^{-4}	4.0×10^{-6}	1.0×10^{-3}
Chronic/Longer Term Exposures				
Contaminated Fruit	Adult Female	5.0×10^{-3}	2.0×10^{-3}	7.0×10^{-2}
Contaminated Vegetation	Adult Female	6.0×10^{-2}	4.0×10^{-3}	5.0×10^{-1}
Water Consumption	Adult Male	9.0×10^{-4}	1.0×10^{-5}	7.0×10^{-3}
Fish Consumption	Adult Male	1.0×10^{-5}	2.0×10^{-7}	9.0×10^{-5}
Fish Consumption	Subsistence Population	1.0×10^{-4}	2.0×10^{-6}	70×10^{-6}

[a] Hazard Quotient is the level of exposure divided by the RfD (reference dose), then rounded to one significant digit.

Table 16 Hazard Quotients for the General Public from Exposures to Chlorsulfuron.

Scenario	Receptor	Central	Lower	Upper
Accidental Acute Exposures				
Direct Spray of child, whole body	Child	1.0×10^{-3}	2.0×10^{-5}	1.0×10^{-2}
Direct Spray of woman, feet and lower legs	Adult Female	1.0×10^{-4}	2.0×10^{-6}	1.0×10^{-3}
Water consumption (spill)	Child	5.0×10^{-2}	4.0×10^{-4}	3.0×10^{-1}
Fish consumption (spill)	Adult Male	2.0×10^{-3}	2.0×10^{-5}	7.0×10^{-3}
Fish consumption (spill)	Subsistence Population	8.0×10^{-3}	1.0×10^{-4}	3.0×10^{-2}
Non-Accidental Acute Exposures				
Vegetation Contact, shorts and T-shirt	Adult Female	1.0×10^{-4}	2.0×10^{-5}	6.0×10^{-4}
Contaminated Fruit	Adult Female	4.0×10^{-3}	2.0×10^{-3}	6.0×10^{-2}
Contaminated Vegetation	Adult Female	5.0×10^{-2}	4.0×10^{-3}	4.0×10^{-1}
Swimming, one hour	Adult Female	2.0×10^{-8}	7.0×10^{-10}	1.0×10^{-7}
Water consumption	Child	2.0×10^{-3}	1.0×10^{-4}	7.0×10^{-3}
Fish consumption	Adult Male	7.0×10^{-5}	7×10^{-6}	1×10^{-4}
Fish consumption	Subsistence Population	4.0×10^{-4}	4.0×10^{-5}	7.0×10^{-4}
Chronic/Longer Term Exposures				
Contaminated Fruit	Adult Female	2.0×10^{-2}	9.0×10^{-3}	3.0×10^{-3}
Contaminated Vegetation	Adult Female	3.0×10^{-1}	2.0×10^{-2}	2.0
Water Consumption	Adult Male	7.0×10^{-5}	8.0×10^{-6}	1.0×10^{-4}
Fish Consumption	Adult Male	5.0×10^{-7}	9.0×10^{-8}	8.0×10^{-7}
Fish Consumption	Subsistence Population	4.0×10^{-6}	7.0×10^{-7}	6.0×10^{-6}

[a] Hazard Quotient is the level of exposure divided by the RfD (reference dose), then rounded to one significant digit.

Table 17 Hazard Quotients for the General Public from Exposures to Aminopyralid.

Scenario	Receptor	Central	Lower	Upper
Accidental Acute Exposures				
Direct Spray of child, whole body	Child	2.0×10^{-3}	1.0×10^{-4}	4.0×10^{-2}
Direct Spray of woman, feet and lower legs	Adult Female	2.0×10^{-4}	1.0×10^{-5}	4.0×10^{-3}
Water consumption (spill)	Child	3.0×10^{-2}	2.0×10^{-3}	4.0×10^{-1}
Fish consumption (spill)	Adult Male	8.0×10^{-4}	8.0×10^{-5}	8.0×10^{-3}
Fish consumption (spill)	Subsistence Population	4.0×10^{-3}	4.0×10^{-4}	4.0×10^{-2}
Non-Accidental Acute Exposures				
Vegetation Contact, shorts and T-shirt	Adult Female	7.0×10^{-5}	1.0×10^{-5}	4.0×10^{-4}
Contaminated Fruit	Adult Female	9.0×10^{-4}	4.0×10^{-4}	1.0×10^{-2}
Contaminated Vegetation	Adult Female	1.0×10^{-2}	8.0×10^{-4}	1.0×10^{-1}
Swimming, one hour	Adult Female	2.0×10^{-9}	9.0×10^{-12}	5.0×10^{-8}
Water consumption	Child	6.0×10^{-4}	7.0×10^{-6}	5.0×10^{-3}
Fish consumption	Adult Male	2.0×10^{-5}	3×10^{-7}	1.0×10^{-4}
Fish consumption	Subsistence Population	8.0×10^{-5}	2.0×10^{-6}	5.0×10^{-4}

Chronic/Longer Term Exposures				
Contaminated Fruit	Adult Female	4.0×10^{-4}	1.0×10^{-4}	7.0×10^{-3}
Contaminated Vegetation	Adult Female	5.0×10^{-3}	3.0×10^{-4}	5.0×10^{-2}
Water Consumption	Adult Male	2.0×10^{-4}	3.0×10^{-6}	1.0×10^{-3}
Fish Consumption	Adult Male	9.0×10^{-7}	2.0×10^{-8}	6.0×10^{-6}
Fish Consumption	Subsistence Population	7.0×10^{-6}	2.0×10^{-7}	5.0×10^{-5}

[a] Hazard Quotient is the level of exposure divided by the RfD (reference dose), then rounded to one significant digit.

Table 18 Hazard Quotients for the General Public from Exposures to Triclopyr.

Scenario	Receptor	Central	Lower	Upper
Accidental Acute Exposures				
Direct Spray of child, whole body	Child	1.0×10^{-2}	2.0×10^{-3}	2.0×10^{-1}
Direct Spray of woman, feet and lower legs	Adult Female	2.0×10^{-2}	5.0×10^{-3}	3.0×10^{-1}
Water consumption (spill)	Child	1.0×10^{-1}	8.0×10^{-3}	1.5
Fish consumption (spill)	Adult Male	$2..0 \times 10^{-4}$	2.0×10^{-5}	2.0×10^{-3}
Fish consumption (spill)	Subsistence Population	9.0×10^{-4}	1.0×10^{-4}	9.0×10^{-3}
Non-Accidental Acute Exposures				
Vegetation Contact, shorts and T-shirt	Adult Female	3.0×10^{-2}	1.0×10^{-2}	9.0×10^{-2}
Contaminated Fruit	Adult Female	2.0×10^{-1}	8.0×10^{-2}	3.0
Contaminated Vegetation	Adult Female	2.0	2.0×10^{-1}	20
Swimming, one hour	Adult Female	3.0×10^{-7}	4.0×10^{-11}	5.0×10^{-5}
Water consumption	Child	2.0×10^{-4}	3.0×10^{-8}	2.0×10^{-2}
Fish consumption	Adult Male	3.0×10^{-7}	1×10^{-10}	2.0×10^{-5}
Fish consumption	Subsistence Population	1.0×10^{-6}	5.0×10^{-10}	1.0×10^{-4}
Chronic/Longer Term Exposures				
Contaminated Fruit	Adult Female	7.0×10^{-2}	2.0×10^{-2}	1.9
Contaminated Vegetation	Adult Female	2.0×10^{-1}	7.0×10^{-3}	5.0
Water Consumption	Adult Male	4.0×10^{-4}	6.0×10^{-11}	3.0×10^{-2}
Fish Consumption	Adult Male	1.0×10^{-7}	3.0×10^{-14}	8.0×10^{-6}
Fish Consumption	Subsistence Population	1.0×10^{-6}	2.0×10^{-13}	6.0×10^{-5}

[a] Hazard Quotient is the level of exposure divided by the RfD (reference dose), then rounded to one significant digit.

Table 19 Hazard Quotient for Workers (Backpack Applicators) for Accidental/Incidental Exposures.

Chemical	Hazard Quotient[a]							
	Contaminated Gloves (1 minute)		Contaminated Gloves (1 hour)		Spill on Hands (1 hour)		Spill on Lower Legs (1 hour)	
	Central	Upper	Central	Upper	Central	Upper	Central	Upper
Aminocyclopyrachlor	1.0×10^{-7}	8.0×10^{-7}	6.0×10^{-6}	5.0×10^{-5}	2.0×10^{-5}	2.0×10^{-4}	4.0×10^{-5}	$x \ 10^{-4}$
Chlorsulfuron	9.0×10^{-7}	5.0×10^{-6}	5.0×10^{-5}	3.0×10^{-4}	3.0×10^{-5}	3.0×10^{-4}	8.0×10^{-6}	$x \ 10^{-4}$
Aminopyralid	2.0×10^{-7}	4.0×10^{-6}	1.0×10^{-5}	2.0×10^{-4}	4.0×10^{-5}	1.0×10^{-3}	1.0×10^{-4}	3.0×10^{-3}
Triclopyr	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-3}	1.0×10^{-2}	3.0×10^{-4}	4.0×10^{-3}	7.0×10^{-4}	1.0×10^{-2}

[a] Hazard Quotient is the level of exposure divided by the RfD (reference dose), then rounded to one significant digit.

Table 20 Hazard Quotient for Workers (Backpack Applicators) for General Exposures

Chemical	Hazard Quotient[a]	
	Central	Upper
Aminocyclopyrachlor	7.0×10^{-3}	$x\ 10^{-2}$
Chlorsulfuron	5.0×10^{-5}	$x\ 10^{-1}$
Aminopyralid	2.0×10^{-3}	1.0×10^{-2}
Triclopyr	2.0×10^{-1}	1.2

[a] Hazard Quotient is the level of exposure divided by the RfD (reference dose), then rounded to one significant digit.

Workers and General Public

Aminocyclopyrachlor

The quantitative risk characterization for workers is summarized in Table 14. The HQs are based on the maximum labeled application rate of 0.28 lb a.e./acre. The HQs for accidental exposures are based on the short/intermediate RfD of 3.5 mg/kg bw/day and the HQs for general exposures are based on the chronic RfD of 0.35 mg/kg bw/day.

For workers, no exposure scenarios, acute or chronic, exceed the RfD at the upper bound of the estimated dose associated with the highest application rate of 0.28 lb a.e./acre. The HQs for directed ground spray, broadcast ground spray, and aerial applications are below the level of concern by factors of 10 to about 17. Similarly, no HQs for aminocyclopyrachlor exceed the level of concern for members of the general public. The highest HQ is 0.8, the upper bound of the HQ for the consumption of broadleaf vegetation. This exposure scenario is standard in all Forest Service risk assessments; moreover, this scenario typically leads to the highest HQs. For an effective herbicide like aminocyclopyrachlor, this exposure scenario may be viewed as implausible in that treated or contaminated vegetation would show signs of damage following the application of the herbicide, which should reduce if not eliminate the possibility of long-term consumption of the treated vegetation. Exposures associated with the consumption of contaminated water are far more likely, and the upper bound HQs for these exposure scenarios are below the level of concern by factors of about 100 (HQ of 0.01 for the longer-term consumption of contaminated water) to 10,000 (HQ of 0.0001 for the longer-term consumption of contaminated fish).

The risk characterization for workers is simple and unambiguous: there is no basis for asserting that workers are likely to be at risk in applications of aminocyclopyrachlor. The highest HQ for general exposures—i.e., exposure levels anticipated in the normal use of aminocyclopyrachlor —is 0.1, the upper bound of the HQ for workers involved in ground broadcast applications of aminocyclopyrachlor.

Risks are explicitly characterized only for workers involved in ground or aerial broadcast applications or direct applications to water. As summarized in Table 6, the highest documented worker exposure rates are associated with directed foliar applications. Some aminocyclopyrachlor formulations may cause eye irritation. From a practical perspective, eye irritation is likely to be the only overt effect as a consequence of mishandling aminocyclopyrachlor; furthermore, this effect is most likely to result from handling granular formulations prior to application. Eye irritation can be minimized or avoided by prudent industrial hygiene practices, including the use of goggles while handling granular formulations of aminocyclopyrachlor.

Aminocyclopyrachlor is not classified as a skin irritant. While some dermal toxicity studies note minor skin irritation, studies designed specifically to assess the potential for dermal irritation are interpreted in U.S. EPA/OPP (2010) as indicating that aminocyclopyrachlor is not a skin irritant. Nonetheless, prudent worker practices should be used when handling any pesticide, to ensure that skin contact is minimized.

The risk characterization for workers derived in the current Forest Service risk assessment is qualitatively similar to the EPA occupational risk assessment (U.S. EPA/OPP 2010), in that the level of concern is not exceeded for any group of workers. The Margins of Exposure (MOEs) derived by the EPA range from 190,000 to 38 million. The MOEs would correspond to HQs that are much lower than those derived for workers in the current Forest Service risk assessment. The differences between the EPA derived MOEs and the HQs derived in the current risk assessment are due primarily to the EPA's decision to include only inhalation and not dermal routes of exposure in the occupational exposure assessment for aminocyclopyrachlor.

The quantitative risk characterization for exposures of the general public to aminocyclopyrachlor is summarized in Table 15. As with the quantitative risk characterization for workers, the HQs for accidental and acute exposures are based on the short/intermediate RfD of 3.5 mg/kg bw/day, and the HQs for longer-term exposures are based on the chronic RfD of 0.35 mg/kg bw/day. Additional studies were submitted to the U.S. EPA/OPP which could result in an upward adjustment of the chronic RfD. While such an adjustment would lower the chronic HQs, this action would have no substantial impact on the qualitative risk characterization, because none of the chronic HQs based on the current chronic RfD exceed the level of concern.

As with workers, there is no basis for asserting that members of the general public are likely to be at risk due to applications of aminocyclopyrachlor. The highest HQs are associated with the consumption of contaminated broadleaf vegetation. The upper bound HQ for acute exposures is 0.1, and the upper bound for chronic exposures is 0.8. These exposure scenarios are extremely conservative in that the consumption of contaminated vegetation is assumed to occur shortly after the direct spray of the vegetation at the maximum application rate of 0.28 lb a.e./acre. The chronic exposure scenarios for the consumption of contaminated vegetation may be viewed as grossly and perhaps overly conservative in that vegetation sprayed with aminocyclopyrachlor at the maximum application rate would probably show signs of damage following treatment, and it does not seem likely that an individual would consume damaged vegetation over a prolonged period of time. This exposure scenario is used consistently in Forest Service risk assessments simply as an upper bound screen for potential risks. For aminocyclopyrachlor, no risks are apparent.

Each of the HQs summarized in Table 15 involves a single exposure scenario. In some cases, individuals could be exposed by more than one route. In such cases, risks can be approximated simply by adding the HQs for different exposure scenarios. For aminocyclopyrachlor, consideration of multiple exposure scenarios has little impact on the risk assessment. For example, based on the upper bounds of HQs for being directly sprayed on the lower legs (HQ=0.0009), staying in contact with contaminated vegetation for 1 hour (HQ=0.0004), eating contaminated fruit (HQ=0.01) and contaminated broadleaf vegetation (HQ=0.1), drinking contaminated surface water (HQ=0.006), and consuming contaminated fish at rates characteristic of subsistence populations (HQ=0.002) lead to a combined HQ of 0.1193 [0.0009 + 0.0004 + 35 0.01 + 0.1 + 0.006 + 0.002]. In other words, for aminocyclopyrachlor, the predominant route of exposure will involve the consumption of contaminated vegetation. This pattern is apparent in most pesticide risk assessments involving foliar applications.

Cyclopropanecarboxylic acid

Cyclopropanecarboxylic acid is considered quantitatively because this degradate of aminocyclopyrachlor is considered a degradate of concern by the U.S. EPA/OPP. The upper bounds of the HQs for the non-accidental exposure scenarios are below the level of concern by factors of about 11 (HQ of 0.09 for the acute consumption of water by a young child) to 25,000 (HQ of 0.00004 for the longer-term consumption of contaminated fish by non-subsistence populations). The only HQ that exceeds the level of concern is the upper bound HQ of 2 for the consumption of contaminated water by a child, following an accidental spill. The peak concentration of cyclopropanecarboxylic acid in water, however, would not occur until about 40 days after the spill. Therefore, in the event of an accidental spill of aminocyclopyrachlor, there would be adequate time to take remedial actions, thus, limiting the likelihood that water contaminated with cyclopropanecarboxylic acid would be consumed.

The quantitative risk characterization for exposures of the general public to cyclopropanecarboxylic acid following an application of aminocyclopyrachlor at the maximum application rate of 0.28 lb. a.e./acre is summarized in Table 21. The assessment of cyclopropanecarboxylic acid includes only the subset of exposure scenarios associated with contaminated water, because cyclopropanecarboxylic acid is formed primarily by the aqueous photolysis of aminocyclopyrachlor.

Table 21 Cyclopropanecarboxylic Acid Risk Characterization for the General Public

Aminocyclopyrachlor Application rate:	**0.28 lb./acre**	**Hazard Quotients**		
Scenario	**Receptor**	**Central**	**Lower**	**Upper**
Accidental Acute Exposures (does in mg/kg/event)				
Direct Spray of Child, whole body	Child	No exposure assessment		
Direct Spray of woman, feet and lower legs	Adult female	No exposure assessment		
Water consumption	Child	0.3	2.0×10^{-3}	2
Fish consumption (spill)	Adult Male	1.0×10^{-2}	1.0×10^{-4}	5.0×10^{-2}
Fish consumption (spill)	Subsistence populations	6.0×10^{-2}	6.0×10^{-4}	3.0×10^{-1}
Non-accidental Acute Exposures (does in mg/kg/event)				
Vegetation contact, shorts and T-shirt	Adult female	No exposure assessment		
Contaminated fruit	Adult female	No exposure assessment		
Contaminated vegetation	Adult female	No exposure assessment		
Swimming, one hour	Adult female	3.0×10^{-5}	5.0×10^{-6}	6.0×10^{-4}
Water consumption	Child	6.0×10^{-3}	1.0×10^{-5}	9.0×10^{-2}
Fish consumption	Adult male	2.0×10^{-4}	6.0×10^{-7}	2.0×10^{-3}
Fish consumption	Subsistence	1.0×10^{-3}	3.0×10^{-6}	1.0×10^{-6}

	populations			
Chronic/Longer-term Exposures (does in mg/kg/event)				
Contaminated fruit	Adult female	No exposure assessment		
Contaminated vegetation	Adult female	No exposure assessment		
Water consumption	Adult Male	5.0×10^{-4}	1.0×10^{-6}	8.0×10^{-3}
Fish consumption	Adult Male	3.0×10^{-6}	1.0×10^{-8}	4.0×10^{-5}
Fish consumption	Subsistence populations	2.0×10^{-5}	9.0×10^{-8}	3.0×10^{-4}

The HQs for accidental and acute exposures are based on the acute RfD of 0.0026 mg/kg bw, and the HQs for longer-term exposures are based on the chronic RfD of 0.00087 mg/kg bw/day. The acute and chronic RfDs for cyclopropanecarboxylic acid are unusual in that they are based on a 2-week toxicity study in rabbits dosed with panadiplon, a drug that is metabolized to cyclopropanecarboxylic acid. a standard subchronic toxicity study of cyclopropanecarboxylic acid has been submitted to the U.S. EPA/OPP. If the U.S. EPA/OPP accepts this study and uses it as the basis for RfDs on cyclopropanecarboxylic acid, it is likely that the acute RfD would increase to 0.1 mg/kg bw (an increase of a factor of about 38) and the chronic RfD would increase to 0.01 mg/kg bw/day (an increase of a factor of about 11).

Changes in the RfDs for cyclopropanecarboxylic acid would have an impact on the qualitative risk characterization only for the accidental spill scenario. As summarized in Table 21, the upper bound HQ for this scenario is 2, and this is the only scenario in which the HQ exceeds the level of concern (HQ>1). If the acute RfD were increased to 0.1 mg/kg bw, the upper bound HQ for this scenario would be 0.05, below the level of concern by a factor of 20.

Based on the current RfDs, all of the non-accidental exposure scenarios are below the level of concern. The highest acute HQ is 0.09, the upper bound of the HQ associated with the consumption of contaminated water by a small child. This HQ is below the level of concern by a factor of more than 10. The highest chronic HQ is 0.008, the upper bound HQ for the consumption of contaminated water by an adult male. This HQ is below the level of concern by a factor of 125.

While the upper bound HQ of 2 for the accidental spill scenario modestly exceeds the level of concern based on the current acute RfD for cyclopropanecarboxylic acid, the time-course of risk is noteworthy. The peak concentration of cyclopropanecarboxylic acid in water following an accidental spill of aminocyclopyrachlor would not occur for about 40 days. Therefore, in the event of an accidental spill of aminocyclopyrachlor, there would be adequate time to take remedial actions, thus, limiting the likelihood that water contaminated with cyclopropanecarboxylic acid would be consumed.

Chlorsulfuron

For both workers and members of the general public, typical exposures to chlorsulfuron do not lead to estimated doses that exceed a level of concern. For workers, the upper range of hazard quotients is below the level of concern for backpack and aerial applications but somewhat above the level of concern for ground broadcast applications at the highest application rate. For ground broadcast applications, the level of concern is reached at an application rate of 0.14 lb/acre. For members of the general public, the upper limits for hazard quotients are below a level of concern except for the accidental spill of a large amount of chlorsulfuron into a very small pond. Even this exposure scenario results in only a small excursion above the acute RfD and is not likely to be toxicologically significant because of the short duration of exposure relative to those considered in the derivation of the RfD.

Mild irritation to the skin and eyes can result from exposure to relatively high levels of chlorsulfuron. From a practical perspective, eye or skin irritation is likely to be the only overt effect as a consequence of mishandling chlorsulfuron. These effects can be minimized or avoided by prudent industrial hygiene practices during the handling of the compound.

Aminopyralid

The risk characterization for both workers and members of the general public is reasonably simple and unambiguous: based on a generally conservative and protective set of assumptions regarding both the toxicity of aminopyralid and potential exposures to aminopyralid, there is no basis for suggesting that adverse effects are likely in either workers or members of the general public even at the maximum application rate that might be used in Forest Service programs.

For workers, no exposure scenarios, acute or chronic, exceeds the RfD at the upper bound of the estimated dose associated with the highest application rate of 0.11 lb a.e./acre. The hazard quotients for directed ground spray, broadcast ground spray, and aerial applications are below the level of concern by factors of 33 to 200 over the range of application rates considered in this risk assessment.

For members of the general public, upper bounds of hazard quotients at the highest application rate are below a level of concern by factors of 100 to 125,000 for longer term exposures. For one accidental exposure scenario, the consumption of contaminated water by a child immediately after an accidental spill of aminopyralid into a small pond, the hazard quotient is 0.6, approaching the level of concern (1.0). This is an intentionally extreme exposure scenario that typically leads to the highest hazard quotient in pesticide risk assessments similar to the current assessment on aminopyralid. The upper bounds of acute exposure scenarios for contaminated vegetation or fruit are below the level of concern by factors of 10 to 50. Acute non-accidental exposure scenarios for members of the general public that involve contaminated water are below the level of concern by factors of about 50 to 500.

The risk characterization given in this risk assessment is qualitatively similar to that given by the U.S. EPA: no risks to workers or members of the general public are anticipated. The current risk assessment derives somewhat higher hazard quotients than those in the U.S. EPA human health risk assessment because the current risk assessment uses a number of extreme exposure scenarios that are not used by the U.S. EPA.

Triclopyr

Overviews of the risk characterization associated with terrestrial applications of triclopyr formulations are presented in Table 14 for workers and Table 15for members of the general public. These tables are discussed in detail in the following subsections.

At the typical application rate of 1 lb a.e./acre, the central estimates of the HQs indicate that workers will not be subject to hazardous levels of triclopyr during applications of triclopyr. At the upper bounds of the estimated exposures for all application methods, the HQs for triclopyr (HQs = 1.6 to 3) exceed the level of concern based on the chronic RfD. Based on the acute RfD, no HQs substantially exceed the level of concern. The HQs based on the acute RfD, however, would only apply to male workers. All HQs for workers will increase linearly with the application rate.

For members of the general public, the only non-accidental exposure scenarios of concern involve the consumption of contaminated fruit or vegetation with consequent exposures to triclopyr and 3,5,6-trichloro-2-pyridinol (TCP), the primary metabolite of triclopyr. At an application rate of 1 lb a.e./acre, the upper bound HQ of 27 for triclopyr in the acute exposure scenario for the consumption of contaminated vegetation by a young woman exceeds the upper bound HQs for occupational exposures. In addition, some of the central estimates of exposure to triclopyr or TCP involving a young woman consuming contaminated vegetation or fruit also exceed the level of concern. Relative to the risks associated with the consumption of contaminated fruit or vegetation, risks associated with other exposure scenarios are marginal.

Because triclopyr has been shown to cause adverse developmental effects in mammals, the high HQs associated with terrestrial applications are of particular concern in terms of the potential for adverse reproductive outcomes in females. Adverse developmental effects in experimental mammals have been observed, however, only at doses that cause frank signs of maternal toxicity. No epidemiology studies or case reports have been encountered that associate human exposures to triclopyr with either frank signs of toxicity or developmental effects. In addition, the available toxicity studies suggest that overt and severe toxicity would not be associated with any of the upper bound HQs. This diminishes concern for reproductive effects in females. Conversely, an epidemiology study on Forest Service personnel conducted by OSHA noted a marginally significant increase in the odds ratios for miscarriages among women in the Forest Service who reported using herbicides. While this analysis does not implicate triclopyr or any other herbicide as a causative agent in miscarriages, the lack of epidemiology studies focused on females of reproductive age with documented exposures to triclopyr adds uncertainty to the risk characterization for terrestrial applications of triclopyr.

Additives

Additives (also known as adjuvants) are mixed with an herbicide solution to improve the performance of the spray mixture by either enhancing the activity of the herbicide's active ingredient or by offsetting problems associated with application, such as water or wind factors (Bakke 2007). The proposed action includes use of a surfactant to increase effectiveness of the herbicide and a locating dye to identify areas that have been treated. The proposed action does not specify the surfactant and dye but the following additives would be appropriate for use in the project: an esterified vegetable oil surfactant (e.g., Competitor® or an equivalent formulation) to facilitate and enhance the spreading and penetrating properties of the herbicides and a marker dye (e.g., Hi-light® Blue or an equivalent formulation) to allow for the identification of plants that have been treated.

Additives are not under the same registration guidelines as are pesticides; therefore much of the information that describes the active ingredients in additives is considered confidential business information (CBI). The EPA does not register or approve the labeling of spray additives, although the California Department of Pesticide Regulation (DPR) does require the registration of those that are considered to increase the action of the pesticide it is used with. All additives are generally field tested by the manufacturer in combination with several different herbicides and non-native, invasive plant species, and under a number of different environmental conditions (Bakke 2007).

The most common risk factor associated with the use of the proposed additives is skin or eye exposure. This risk can be minimized through good industrial safety practices (i.e. personal protective eyewear and gloves) while utilizing these products. Overall, the additives proposed for use within the project are not expected to pose an adverse risk to the health and safety of workers or members of the general public. This is based on information provided on the product labels as well as in the discussion contained in Bakke (2007) in which the two additives proposed for use under this project are discussed and some acute toxicity data presented. The following provides further discussion of two additives commonly used in noxious weed applications.

Competitor® (or an Equivalent Formulation)

Product labels contain "signal words" (caution, warning, danger, and poison) which indicate the product's relative toxicity to humans. The signal word is assigned using a combination of acute toxicity studies and the toxicity of each of the product's components (Tu et al. 2001). Competitor® has been assigned a "caution" signal word and the label indicates that improper use may cause irritation to the skin and eyes.

The main ingredient in Competitor® is an esterified vegetable oil. It also contains two emulsifiers, sorbitan alkylpolyethoxylate ester and dialkyl polyethoxylene glycol. Vegetable oil surfactants are gaining in popularity due to their capability to increase herbicide absorption and spray retention (Bakke 2007). The U.S. Food and Drug Administration (FDA) considers methyl and ethyl esters of fatty acids produced from edible fats and oils to be food grade additives (21 CFR 172.225). However, because of the lack of exact ingredient statements on these surfactants, it is not always clear whether the oils used meet the U.S. FDA standard.

Hi-light® Blue (or an Equivalent Formulation).

Hi-Light® Blue dye is not required to be registered as a pesticide; therefore there is no signal word included on the label. However, according to Bakke (2007), this product would likely have a "caution" signal word if required to identify one. The label does indicate that this product is mildly irritating to the skin and eyes. Hi-Light® Blue is commonly used in toilet bowl cleaners and as a colorant for lakes and ponds (SERA 1997). This dye is water-soluble, contains no listed hazardous substances, and is considered virtually non-toxic to humans (SERA 1997, Bakke 2007) .The effect of use on non-target terrestrial and aquatic species is unknown; however the use of this dye has not resulted in any known problems (Bakke 2007).

The use of Hi-Light® Blue in the proposed herbicide formulations would result in almost no increased risk to the health and safety of the workers or members of the general public. The use of dye in herbicide application can reduce likelihood and risk of exposure by facilitating avoidance of treated vegetation.

Synergistic Effects

Synergistic effects are those effects resulting from exposure to a combination of two or more chemicals that are greater than the sum of the effects of each chemical alone (additive). Refer to USDA (1989, as referenced in USDA 2003) for a detailed discussion on synergistic effects.

It is not anticipated that synergistic effects would be seen with the additives proposed in the project. Based on a review of several recent studies, there is no demonstrated synergistic relationship between herbicides and surfactants (Abdelghani et al 1997; Henry et al 1994; Lewis 1992; Oakes and Pollak 1999, 2000 as referenced in Bakke 2007).

Although the combination of surfactant and herbicide might indicate an increased rate of absorption through the skin, a review of recent studies indicates this is not often true (Ashton et al 1986; Boman et al 1989; Chowan and Pritchard 1978; Dalvi and Zatz 1981; Eagle et al 1992; Sarpotdar and Zatz 1986; Walters et al 1993, 1998; Whitworth and Carter 1969 as referenced in Bakke 2007). For a surfactant to increase the absorption of another compound, the surfactant must affect the upper layer of the skin. Without some physical effect to the skin, there will be no change in absorption as compared to the other compound alone. The studies indicate that in general non-ionic surfactants have less of an effect on the skin, and hence absorption, then anionic or cationic surfactants. Compound specific studies indicate that the alkylphenol ethoxylates generally have little or no effect on absorption of other compounds. In several studies, the addition of a surfactant actually decreased the absorption through the skin. It would appear that there is little support for the contention that the addition of surfactants to herbicide mixtures would increase the absorption through the skin of these herbicides.

Sensitive Individuals

There is no information to suggest that specific groups or individuals may be especially sensitive to the systemic effects of aminocyclopyrachlor. It is not clear that aminocyclopyrachlor has any remarkable systemic toxic effects. The most common effects in experimental mammals involve decreases in body weight, body weight gain, and food conversion efficiency in rats. These effects have not been noted in other mammals and appear to be associated with levels of exposure that are substantially higher than any likely human exposures. Thus, it would seem highly speculative and unjustified to suggest that individuals with metabolic disorders might be more susceptible than other individuals to aminocyclopyrachlor.

Notwithstanding the above, aminocyclopyrachlor is a weak acid. It seems reasonable to suggest that aminocyclopyrachlor would influence and be influenced by other weak acids excreted by the kidney; however, this effect would occur only at high doses at which the ability of the kidney to excrete weak acids might be saturated or nearly so. Given the low HQs for aminocyclopyrachlor, there appears to be no basis for asserting that this or other adverse effects in a specific subgroup are plausible.

There is no information to suggest that specific groups or individuals may be especially sensitive to the systemic effects of aminopyralid or triclopyr (SERA 2007a, 2011).

There is no information to suggest that specific groups or individuals may be especially sensitive to the systemic effects of chlorsulfuron. Due to the lack of data in humans, the likely critical effect of chlorsulfuron in humans cannot be identified clearly. In animals the most sensitive effect of chlorsulfuron appears to be weight loss. There is also some evidence that chlorsulfuron may produce alterations in hematological parameters. However, it is unclear if individuals with pre-existing diseases of the hematological system or metabolic disorders would be particularly sensitive to chlorsulfuron exposure. Individuals with any severe disease condition could be considered more sensitive to many toxic agents.

The uncertainty factors used in the development of the reference dose (RfD) takes into account much of the variation in human response. The uncertainty factor of 10 for sensitive subgroups is sufficient to ensure that most people will experience no toxic effects. "Sensitive" individuals are those that might respond to a lower dose than average, which includes women and children. The quantitative differences in toxicity between children and adults are usually less than a factor of approximately 10-fold. An uncertainty factor of 10 for sensitive subgroups may not cover all individuals that may be sensitive to herbicides because human susceptibility to toxic substances can vary by two to three orders of magnitude. Factors affecting individual susceptibility include diet, age, heredity, preexisting diseases, and life style. Individual susceptibility to the herbicides proposed in this project cannot be specifically predicted. Unusually sensitive individuals may experience effects even when the HQ is equal to or less than 1.

Cumulative Effects

Cumulative effects may involve either repeated exposures to an individual agent or simultaneous exposures to the agent of concern (in this case aminocyclopyrachlor) and other agents that may cause the same effect or effects by the same or a similar mode of action. In terms of repeated exposures, the current risk assessment does specifically consider the effect of repeated and longer-term exposures to aminocyclopyrachlor for both workers and members of the general public. Consequently, the risk characterizations presented in this risk assessment for longer-term exposures specifically address and encompass the potential impact of the cumulative effects of aminocyclopyrachlor. There is no basis for asserting that longer-term or repeated exposures to aminocyclopyrachlor at doses corresponding to the RfD will lead to cumulative adverse effects.

The U.S. EPA/OPP often addresses cumulative risks associated with exposures to other compounds that have similar modes of action. In the current EPA documents on aminocyclopyrachlor, however, cumulative risk is not specifically addressed (U.S. EPA/OPP 9 2010a,). The mechanism of the herbicidal effects of aminocyclopyrachlor is well characterized; however, the specific mechanism of action in mammals (if any) is unclear. Consequently, risks associated with exposures to other compounds with similar mechanisms of action in mammals cannot be elaborated.

The use of aminocyclopyrachlor will involve exposures to cyclopropanecarboxylic acid. The potential for cumulative effects from combined exposures to these two agents, however, does not seem substantial. There will be a lag period of about 40 days between peak contamination of surface water with aminocyclopyrachlor and the peak formation of cyclopropanecarboxylic acid. Given the low toxicity of aminocyclopyrachlor and cyclopropanecarboxylic acid, the available data do not suggest that cumulative effects associated with co-exposure to aminocyclopyrachlor and cyclopropanecarboxylic acid are a substantial concern.

Based on the hazard quotients summarized in tables 14 and 15, as discussed above, there is no indication that repeated exposures will exceed the threshold for toxicity.

A number of different agents, some of which are either food items or food additives, have been shown to induce cecal enlargement in rodents. It is not clear, however, that the mechanisms of action of these food items or food additives are identical to the mechanism of action of aminopyralid in rodents. In addition, it is not clear that the effect on the rodent cecum caused by aminopyralid or these other agents is relevant to potential effects in humans.

The nearest area of the Plumas National Forest where herbicides may be legally applied is 5.8 air miles from the Rush Skeleton Weed Herbicide Project area.

The current risk assessment does specifically consider the effect of repeated and longer-term exposures to aminopyralid for both workers and members of the general public. The chronic RfD is used as an index of acceptable longer-term exposures. Consequently, the risk characterizations presented in this risk assessment for longer-term exposures specifically address and encompass the potential impact of the cumulative effects of aminopyralid. There is no basis for asserting that cumulative adverse effects associated with longer-term or repeated exposures to chlorsulfuron, aminopyralid, or triclopyr, are plausible.

Cumulative effects from the proposed herbicides may result from (a) repeated exposure to one particular chemical or (b) simultaneous exposure to a particular chemical and other agents that may cause the same effect or effects by the same or similar modes of action.

This risk assessment determined that there is a low likelihood of cumulative adverse effects associated with long-term or repeated exposures to the proposed chemicals.

Worksheets

All worksheets related to the information noted in this document can be found in the project record and are hereby incorporated by reference.

Soil and Water Resources

Effects Analysis Methodology

Scope of the Analysis

The geographic area examined for direct and indirect effects is at the proposed project treatment area scale. This 42 acre analysis area is identified in this document as the “project analysis area”. The project analysis area is at an elevation of approximately 4,800 feet and is adjacent to National Forest System road 23N37 in Township 22N, Range 11E, Section 1, SE ¼ of NE ¼ (Figure 1). The Proposed Action would treat rush skeleton weed on approximately 1.5 acres and would include identification and treatment of new or expanded infestations on a maximum of 42 acres. The timespan of the Rush Skeleton Weed project would be ten years.

The geographic area examined for cumulative watershed effects consists of the three Hydrologic Unit Code 7 (HUC7) watersheds that the project analysis area drains into (Figure 1). This area is identified in this document as the “watershed analysis area”. The three HUC7 watersheds that make up the watershed analysis area total 25,010 acres and are located within south-eastern portion of the larger 200,732 acre Lake Davis/Middle Middle Fork Feather River HUC5 watershed.

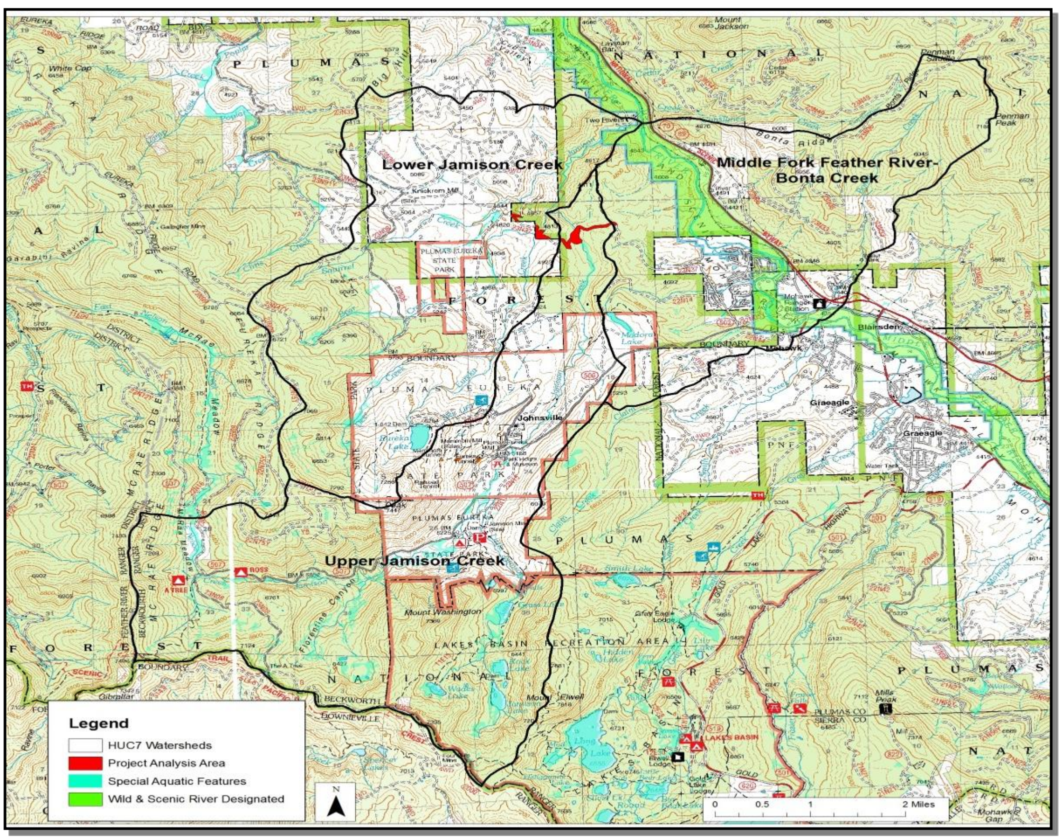


Figure 1 Map depicting project watersheds, project analysis area, cumulative watershed effect analysis area and the HUC 7 watersheds.

The timespan for the cumulative watershed analysis ranges from 10 to 25 years, depending on the type of disturbance activity contributing to cumulative effects. Recovery of ERA associated with modeled disturbances was assumed to occur linearly over time. No temporal component was included for existing roads, regardless of when they were constructed. This assumes that the existing roads get enough use and/or maintenance to maintain them in their current state. The timeframes chosen to analyze the effects of anthropogenic and natural disturbances to watersheds reflect the resultant recovery of changes to watershed function, specifically surface runoff patterns and timing.

Water and Soil Effects Methodology

Project design standards were developed to ensure compliance with Federal and State laws, Region Five direction, Plumas National Forest LRMP and the 2004 SNFPA. Information used to develop these design standards were derived from the analysis the Syracuse Environmental Research Associates (SERA) risk assessment documents developed for the each of the proposed herbicides (SERA, 2004, 2007, 2011, and 2012), SERA risk assessment worksheet calculations with proposed application rates, soil characteristics and properties relative to herbicide properties and the proximity of treatment sites to streams. The risk assessments, interdisciplinary team discussions, and monitoring studies of herbicide use on known infestations of rush skeleton weed were used to create design standards, particularly for stream buffers and near water resources, to protect streams from potential adverse effects of treatments.

Herbicide degradation in the environment is tied strongly to soils. The analysis focuses on herbicide application since this is the highest risk of the three steps in the Proposed Action. Main topics compared across the alternatives are (1) soil and water interactions, (2) the risks to soil biology and (3) vegetation cover and soil erosion.

The Forest Service has a contract with Syracuse Environmental Research Associates (SERA), Inc. to conduct human health and ecological risk assessments. Analysis for herbicide effects used published assessments from SERA, which provided parameters of degradation in various mediums, adsorption in soil, solubility in water, and toxicity to aquatic organisms. These parameters were used to assess potential risk of chemical transport in groundwater, effect to organisms in natural water bodies, and effects to soil organisms.

The Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) Driver model (Website: http://www.tifton.uga.edu/sewrl/Gleams/gleams_y2k_update.htm) examines the fate of herbicides in various soils under a variety of environmental conditions. This model was used for all the Forest Service SERA risk assessments. This is a well-validated model for herbicide transport and is the best available science. The SERA Risk Assessment analysis takes the herbicide concentrations provided by GLEAMS-Driver and uses them in a dilution model for a stream and/or pond to get the water contamination rates for specific scenarios. The risk assessment model assumes aerial application along a small perennial stream without any protection buffers. In most cases, a 10-acre square field was used in the model as well as an even rainfall every 10 days. Modeling 10 acres along a stream would overestimate herbicide in streams on the Forest as no aerial application of herbicide is proposed anywhere and restrictions would apply to herbicide use near water (different herbicides depending on proximity to water). The SERA worksheets were adjusted for the application rates to be used under this project. While the parameters do not always accurately reflect parameters at treatment sites, using this approach is considered conservative because in actuality the infestations are scattered, design standards would be applied and aerial applications are not allowed. The model is conservative and probably overestimates herbicide concentrations because it assumes aerial application along a stream as opposed to the targeted treatment proposed with this project.

Soil properties primarily derived from the Soil Survey Geographic Database (USDA NRCS, 2008) and the Plumas National Forest Soil Resource Inventory (USDA, 1988b) were used to assess the effects to soils within the project analysis area. The soil survey has accuracy at about 40 acres for the map units. The map units may consist of several soil types depending on the variability of the terrain. Topographical and elevation derivatives, along with the Forest Service corporate data layers for hydrology and geology were used to decipher likelihood of soil types within mapping units.

The project analysis area was correlated against soil parameters, stream channels, special aquatic features, climate, elevation and other site specific features. Trends from this assessment were compared against available information in literature to predict occurrence and likelihood for herbicide treatment for interpreting effects.

Water and Soil Effects Data Sources

- Forest Service Corporate GIS layers of the following: HUC watersheds, project-delineated sub-watersheds, land ownerships, soils, roads, and streams and special aquatic features.
- Rush Skeleton Weed proposed project area GIS layer.
- 2010 and 2012 National Agriculture Imagery Program (NAIP) imagery.
- Hydrological GIS layers from the National Hydrologic Data Center.
- Forest Service monitoring reports and published literature.

Cumulative Watershed Effects Methodology

There are numerous methods for assessing cumulative watershed effects (CWE) associated with land use activities (Dunne et al., 2001; Berg, 1996). For the purpose of this CWE analysis, the effects of past, present, and reasonably foreseeable future impacts were assessed using the Region 5, Cumulative Watershed Effects Equivalent Roaded Acres (ERA) model (USDA, 1988c). Please refer to Rush Skeleton Weed Project Soil and Water Resources Report (USDA 2014b) for specific discussion on the CWE ERA model methodology.

Affected Environment

Precipitation

The general climate within the vicinity of the project analysis area ranges from semi-warm to hot, dry summers and cold, wet winters. The Portola Weather Station (#047085)[1] data, which is approximately 12 air miles east of the project analysis area, depicts average total monthly precipitation. Precipitation totals typically occurs between November and March and approximately half of the annual precipitation falls during December, January and February, where the average monthly precipitation is typically greater than 3 inches per month. Correspondingly, the warmest months, which range from June through September, have the lowest precipitation averages for these months (Figure 2).

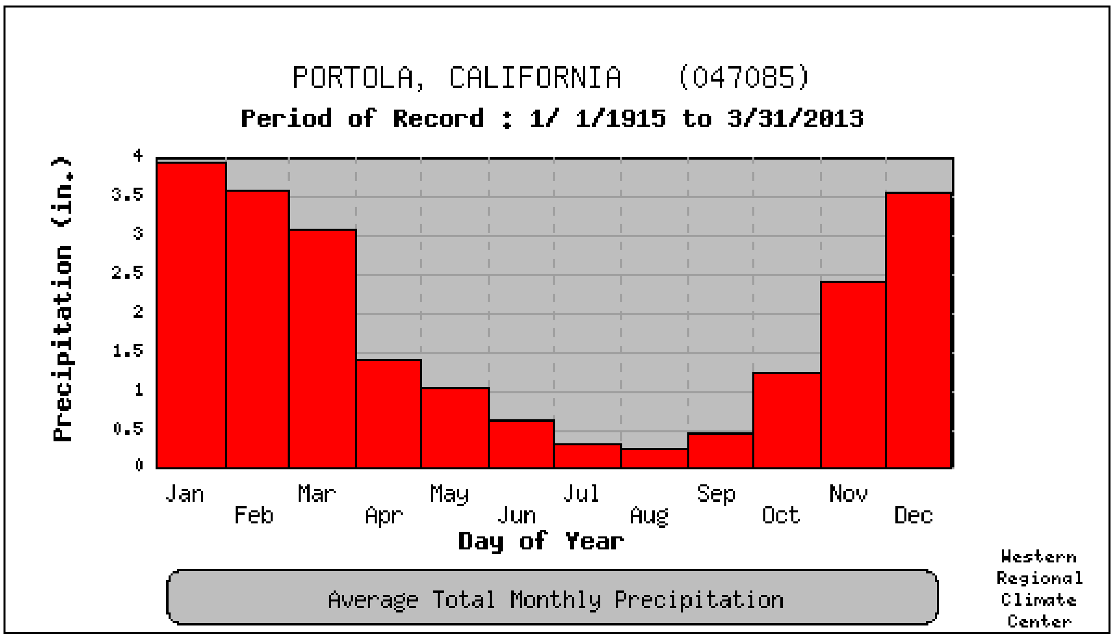


Figure 2 Average total monthly precipitation totals in inches at the Portola Weather Station.

[1] Precipitation data was collected at Portola Weather Station (#047085). Precipitation data was attained from the Western Regional Climate Center website at http://www.wrcc.dri.edu/.

Figure 3 depicts monthly precipitation totals from Jun 2013 to July 2014 at the Plumas Eureka State Park Weather Station (EWS) which is approximately 1-2 air miles from the project analysis area.

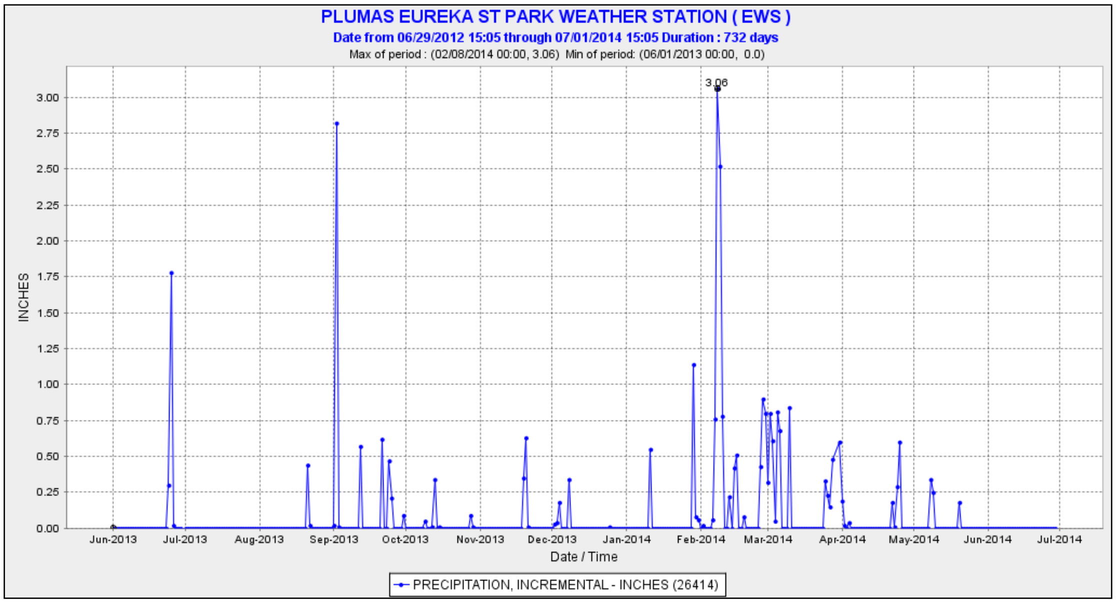


Figure 3 Monthly precipitation totals at Plumas Eureka State Park Weather Station (EWS)[2] from Jun 2013 to July 2014.

Annual precipitation ranges from 7 to 41 inches, averaging around 21 inches per year, and is relatively consistent throughout the project area yielding approximately 1,407 to 1,760 acre feet of runoff. All surface waters within the watershed analysis area drain into the Middle Fork of the Feather River. Surface runoff depends upon the snowmelt regime, which normally extends into late spring and early summer. Approximately 70 percent of precipitation that falls in the watershed analysis area is as snow, with yearly snowfall totals varying from 48 to 72 inches.

Precipitation probabilities for both a one day and thirty day duration are at their lowest levels during July, August and the beginning of September (Figures 5 and 6). The percent probability of the project location receiving 0.01 to 1.0 inch of precipitation from July to the beginning of September in a 1-day period is less than 5 percent (Figure 4).

[2] Precipitation data was collected at the Plumas Eureka State Park Weather Station (EWS). Precipitation data was attained from the Department of Water Resources California Data Exchange Center website at http://cdec.water.ca.gov/.

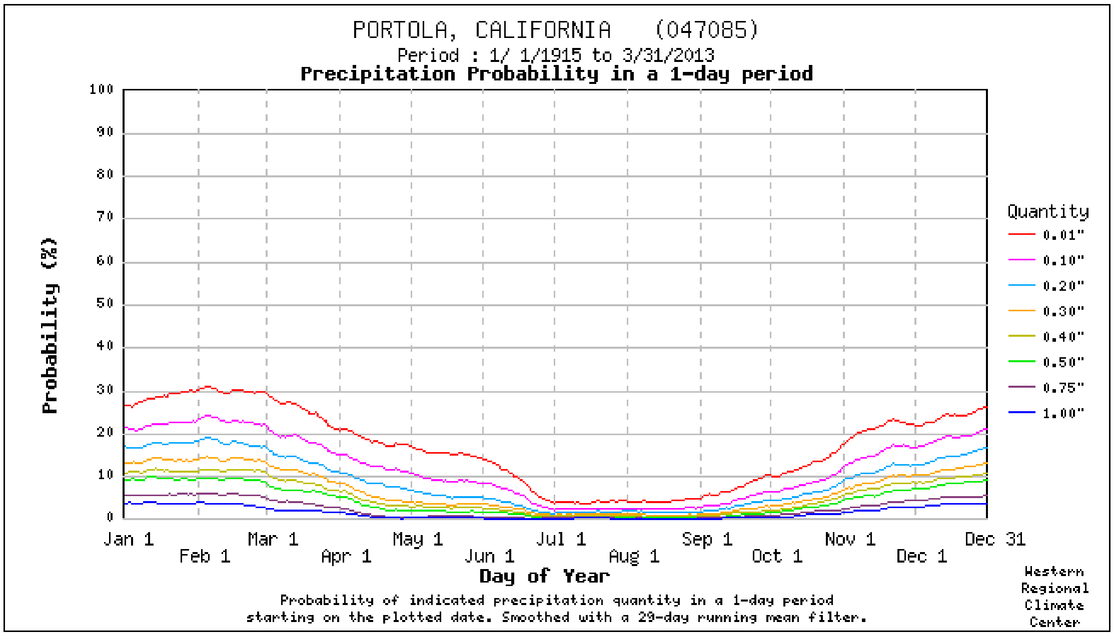


Figure 4 Precipitation probability by duration in a 1-day period at Portola, CA Station #047085[6].

The probability of the project location receiving its respective average monthly precipitation totals from July to September is approximately 55 percent in a 30-day period. However, there is a less than 10 percent probability of precipitation that would be 1 inch in a 30-day period from July to September (Figure 5).

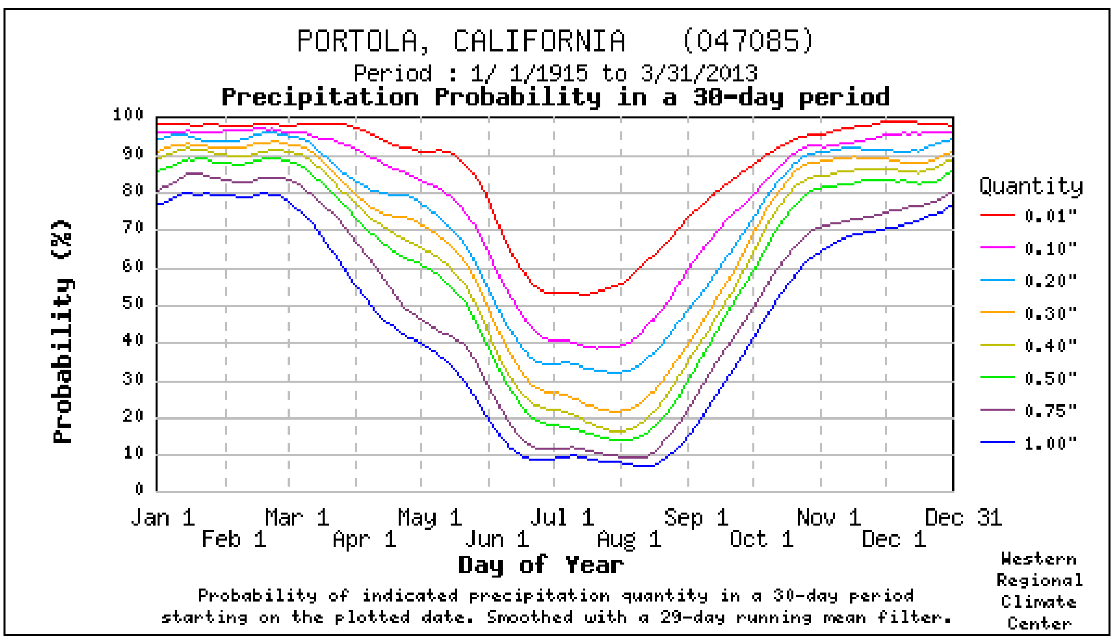


Figure 5 Precipitation probability by duration in a 30-day period at Portola, CA Station #047085[6].

Treatment occurring during the months of July to early September has the lowest probability of precipitation during the year and the lowest probability of a precipitation event occurring that would produce quantities between 0.10-1.0 inches (Figure 3, Figure 4, Figure 5).

Soils

Invasive plants can alter soil properties such as pH, nutrient cycling, and changes in composition or activity of soil microbes. Reductions in soil nutrient levels make it difficult for native plants to compete with the invasive plants, and probably affect the soil biotic community health (USDA, 2006).

Plants and mycorrhizal fungi are strongly dependent on each other, and species of fungi are associated with specific plants. Presence of non-native plants also leads to changes in the mycorrhizal fungus community (Torri and Borselli, 2000; Fryrear, 2000). These changes could increase the difficulty of reestablishing native vegetation after the invasive plants are removed. Noxious weeds directly limit nutrient availability to native species by out-competing native species for limited soil resources. Weeds have high nutrient uptake rates and can deplete soil nutrients to very low levels, especially in cases where weed species germinate prior to native species and exploit nutrient and water resources, before native species are actively growing (Olson, 1999).

Weed-infested areas may also indirectly limit nutrient availability as a result of soil erosion from compacted conditions or reduced effective cover. Erosion selectively removes organic matter and the finer sized soil particles that store nutrients for plant use, leaving behind soil with a reduced capacity to supply nutrients.

The effect of a chemical treatment on the soil depends on the particular characteristics of the chemical used, how it is applied, and the physical, chemical and biological condition of the soil medium. Inherent soil properties serve as a gross estimate for site productivity since soils represent a holistic picture of the interactive effects of soil biology, plants, and moisture and parent material. A soil type gives an averaged value of site water potential since soils develop from percolating precipitation over millennia.

Soils of concern were identified based on a soil's drainage, permeability, depth, infiltration, erosion factor and maximum erosion hazard rating (USDA 2014b, table 2). Soil drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cement pan, or other layers that affect the rate if water movement. Soil permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. Soil depth is a measurement from the upper to the lower soil boundaries. Soil infiltration is a measurement of how quickly water can infiltrate into the soil from the surface (runoff potential).

Erosion factor K is one of six factors used in the Universal Soil Loss Equation to predict the average annual rate of soil loss by sheet and rill erosion in tons per year. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water. Maximum erosion hazard rating (EHR) is soil's susceptibility to become detached or transported by erosive agents such as rainfall, runoff, etc. The EHR system was used to develop the project standard for the amount of soil cover necessary to prevent detrimental accelerated soil erosion. The five soil erodibility classes are low, moderate, moderate-high, high and very high (USDA, 1988a).

Soils with any of the following characteristics were defined as being sensitive for herbicide treatment:

- Soils with soil drainage of somewhat excessive to excessively drained.
- Soils with a permeability of moderately rapid or rapid.

Soils with a lithic[3] or para-lithic[4] contact (soil depth of less than 12 inches to bedrock) or a soil with a depth to bedrock of less than 20 inches. These soils are defined as “shallow”.

- Soils with an erosion factor K rating of 3.0 or greater.
- Soils having maximum erosion hazard ratings of high to very high, and those with a runoff potential rating of high to very high.
- Those areas classified as rubble lands, lava fields and rock outcrops, due to high incidences of fracturing.

All map unit (MU) components within the project analysis area are considered sensitive due to their soil attributes. They comprise of Chaix-Wapi families complex and Riverwash-Fluvents complex (USDA 2014b, table 2 and Figure 7). There are no map units that are classified as rubble lands, lava fields or rock outcrops with the project analysis area. Treatment on these sensitive soils will follow all applicable design standards (USDA 2014b, Table 5), Best Management Practices (Appendix E), and the Water Quality Monitoring Plan (Appendix F).

Water Resources

Watershed Conditions

Based on analysis done for the 2006 Lake Davis Watershed Assessment, the watershed analysis area was determined to be hydrologically stable, with isolated stream reaches that are in poor to fair condition, due to the effects of activities related to site-specific impacts from logging and related infrastructure, such as landings, temporary roads, and skid trails. Additional causes of site-specific disturbances within the watershed analysis area include but are not limited to mining, road construction, wildfire, recreation activities, or from private development and related infrastructure.

[3] A **lithic contact** is the boundary between soil and a coherent underlying material

[4] A **paralithic contact** is a contact between soil and paralithic materials (defined below) where the paralithic materials have no cracks or the spacing of cracks that roots can enter is 10 cm or more.

Paralithic materials are relatively unaltered materials (do not meet the requirements for any other named diagnostic horizons or any other diagnostic soil characteristic) that have an extremely weakly cemented to moderately cemented rupture-resistance class.

Stream Conditions

Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. Roots help stabilize stream banks, preventing accelerated bank erosion and providing for the formation of undercut banks, important cover for juvenile and adult fish. Riparian vegetation stabilizes streambanks, and serves as a filter to prevent the runoff of soil into streams. Riparian vegetation also provides large and small wood to streams, adding to habitat complexity, and providing cover and food sources for aquatic organisms. Aquatic ecosystems have evolved with certain vegetation types; invasive plants do not necessarily provide similar habitat.

The 2004 amendment to the Sierra Nevada Framework defines two areas of interest: Riparian Conservation Areas (RCAs) and Critical Aquatic Refuges. The delineations for RCAs (USDA 2014b, Table 1) are from the Sierra Nevada Forest Plan Amendment (SNFPA) FEIS Record of Decision (USDA, 2004).

Riparian areas will be protected in a manner consistent with the Riparian Conservation Objectives (RCO) (USDA 2014b) and RCA designation and desired conditions. Table 22 outlines project stream and aquatic buffer widths as they relate to the herbicide treatment as mentioned above. Buffers for live water should provide sufficient protection in the event flow is encountered in a channel that is typically of short duration.

Table 22 Stream and Aquatic Features Buffer Widths for Herbicide Application

HERBICIDE ACTIVE INGREDIENT	**LIVE WATER (Perennial streams, springs, wetlands, etc.)**		**NO LIVE WATER (Seasonal wetlands when dry; seasonally flowing / intermittent channels that support a continual strip of riparian vegetation)**		**Dry washes without riparian vegetation**
	Herbicide Application Method				
	Directed spray	**Select**	**Directed spray**	**Select**	
Amino-cyclopyrachlor	15 ft	10 ft	15 ft	No buffer required	No buffer required, unless otherwise specified by project design standards.
Chlorsulfuron	15 ft	10 ft	15 ft	No buffer required	
Aminopyralid	15 ft	10 ft	15 ft	No buffer required	
Triclopyr	15 ft	10 ft	15 ft	No buffer required	

- Buffer distances are measured from the streambank or water's edge.
- Roadside ditches will be treated the same as the water body type they resemble.
- Herbicide application methods are limited to "select" (e.g. wicking, wiping, stem injection, and hack and squirt), and "directed spray" (use of backpack sprayer or hand held nozzle to aim application at specific target species), as permitted by the product label and project design standards. **No broadcast or aerial herbicide applications will occur.**
- Toxicity, soil mobility, and runoff potential were considered in selecting buffer distances and application methods allowed. In some instances, buffer distances are greater than those provided in the product label, in order to comply with USFS Best Management Practices for Water Quality.

Based on available GIS data, an assessment of the project analysis areas determined that there are no defined Critical Aquatic Refuges (CARs) within the proposed treatment areas. However, there is a CAR located within the watershed analysis area. This CAR is not expected to be effected by the Proposed Action.

Within the watershed analysis area there are the two perennial fish bearing stream channels of Jamison and Eureka Creeks and several special aquatic features (SAFs) (Figure 2). Stream and SAF surveys indicated that in the past, logging practices, road construction, and mining activities contributed to riparian and wetland area degradation. Isolated reaches along Jamison and Eureka Creeks were noted where there was streambank erosion or other types of site-specific disturbance present.

While invasive plants would not directly replace riparian shrubs, in degraded areas where shrubs are no longer present, invasive plants can occupy sites and out-compete native vegetation, limiting opportunities for native shrubs to reoccupy the site.

Wild and Scenic Areas

About 70 miles of the Middle Fork Feather River is designated a Wild and Scenic River. All channels in and above the project and watershed analysis areas flow into the Middle Fork of the Feather River which is a federally designated Wild and Scenic River. However, no portion of the project analysis area is proposed within the Wild and Scenic River corridor of the Middle Fork Feather River. Therefore, water quality of the Middle Fork Feather River will not be carried forward in this analysis.

Stream Flow Response

The project analysis area flows directly into perennial drainages of Jamison and Eureka Creeks, both of which sustain flows throughout the year. Jamison and Eureka Creeks ultimately flow into the Middle Fork of the Feather River approximately 1.4 miles directly downstream of the project analysis area. Field surveys of the project analysis area conducted in 2013 and 2014 found several special aquatic features in close proximity to Eureka Creek (USDA 2014b, Figure 2).

The amount of water that runs off three HUC7 watersheds that flow directly into the project analysis area is related to the type of precipitation events (snowmelt versus rainfall) and rainfall intensity and duration. High-intensity and short-duration summer storms have a tendency to yield more runoff than fall and winter storms. As the runoff increases, so does the energy to erode hillsides and transport sediment and applied herbicide to the stream networks.

Groundwater flow is primarily driven by force of gravity and the height of hydraulic head (depth of water in a soil mass). Working against these forces are the molecular attraction of water to soil particles (surface tension) and osmatic pressure applied by plant roots and evaporation. Surface tension obviously far exceeds gravity for this is the force that allows capillary action, the drawing of moisture up a soil column such as occurs between water table and drier soil above. When discussing solute transport properties in soil, this surface tension is expressed as adsorption. Similarly, osmosis applied by plants must exceed gravity and pressure head or plants would not be able to uptake soil water.

Precipitation water infiltrating into a soil disperses as it moves around soil particles filling pore spaces. An inch of rainfall moving into a sandy soil that is nearly completely dry may penetrate about half a foot before dispersion of water to a thin film around soil grains and surface tension hold it in place. The line of separation between soil moistened by infiltrating water and the drier soil below is called a wetting front. During the long droughty summers typical for the project area, the soil water content is brought down to very low levels through evaporation and osmatic pressure (Bales et al., 2011). Whatever water had percolated into the soil column beyond the rooting depth will tend to stay in place in the drier months because of lack of hydraulic head.

In the fall, initial dry soil conditions create a sporadic and weak stream flow response. Most infiltrating rain water is simply absorbed by the soil, filing empty pores, adsorbing onto bounding soil particles. Air trapped within the pores, however, also exerts resistance to infiltrating water (Wangemann et al., 2001) along with soil crusting that creates initial hysteresis[5]upon wetting (Shakesby, 2000). Even with high volume rainfall, stream response may be slight until soil pores fill with water beyond field capacity and hydraulic head builds. As soil moisture increases into winter, successive storm sets bring quicker stream response, sustaining broader peaks in the hydrograph, even with smaller precipitation events. However, by late spring and through summer higher temperature and low relative humidity increase evapotranspiration causing a sharp, steady decline in flow.

The Middle Fork of the Feather River tends to be low to moderate velocity during the summer to fall months (June to November) typically being less than 25cfs (Department of Water Resources, 2013). Discharge data collected by California Department of Water Resources and reported through the California Data Exchange Center website (http://cdec.water.ca.gov/) the Middle Fork Feather River data recording station near Portola (MPF) depicts variable high peak flows ranging from 393.81 cubic feet per second (cfs) (2014) to 4,850.74 cfs (2011) (USDA 2014b,Figures 8 and 9). Based upon channel flow responses depicted in Figures 8 and 9 for the Middle Fork of the Feather River at the Portola station (MPF) along with monthly precipitation averages at Portola (USDA 2014b,Figure 3) and monthly precipitation totals at Plumas Eureka State Park (USDA 2014b, Figure 4), precipitation probability for a 1-day period (USDA 2014b, Figure 5) and 30-day period (USDA 2014b, Figure 6), a correlation can be made for estimating channel flow response timing during the year along with predicting precipitation timing within Jamison and Eureka Creeks and the project analysis area.

Past, Present, and Future-Foreseeable Actions

Past Actions

Timber harvesting had impacts on soils in several ways; compaction resulting from road, skid, and landing construction; removal or displacement of topsoil; loss of soil due to mass movement or surface erosion. Mass movement is triggered by misplaced logging roads, because of raised pressures on soils and by reduced root tensile strength from decaying root systems of harvested trees. Loss of soil was generally caused by increased overland flow of water resulting from roads, landings, and yarding operations. Changes to soil temperature have resulted from increased solar radiation and changes to soil moisture because of decreased evapotranspiration and soil rain interception. Soil chemical and biological processes were probably altered. For example, incorporation of large volumes of fresh organic matter into the soil

[5] **Hysteresis** in soil is defined as the difference in the relationship between the water content of the soil and the corresponding water potential obtained under wetting and drying process.

can shift the Carbon/Nitrogen ratios, while piling or chipping and removing organic matter from the site can reduce the nutrient available to the soil.

Past activities on other non-NFS lands that are either within or adjacent to the project analysis areas may include the use of herbicide and pesticide for agriculture or vegetation management for weed control. The California Department of Pesticide Regulation reports California's annual pesticide use on all "agricultural use". The reporting requirements for agricultural use include pesticide application to parks, golf courses, cemeteries, rangeland, pastures, and along roadside and railroad right-of-way, along with post-harvest pesticide treatments of agricultural commodities. However, the exceptions to these requirements are home-and-garden use and most industrial and institutional uses. There are no concerning cumulative effects associated with development within the watershed analysis area.

Based upon the proposed herbicide application locations and rates it is expected that there would be no cumulative effects associated with the Proposed Action. The design standards, BMPs and water quality monitoring plan would help nullify any potential cumulative detrimental effects from upstream usage with the addition of herbicides used for this project. For a full description of the actual monitoring related to this project, please refer to the Water Quality Monitoring Plan in Appendix F.

Most of the recreation use within the watershed analysis area consists of dispersed activities by individuals and small groups, which include walking, hiking, horseback riding, mountain biking, pleasure driving, off-roading, canoeing, kayaking, rafting, swimming, wildflower viewing, wildlife watching, hunting, fishing, target shooting, and occasionally camping. There are no developed recreation facilities, but several fishing access points are within the project analysis area.

Present or Foreseeable Future Activities

Past, present and future-foreseeable projects and activities that have, are and will occur within the project analysis and watershed analysis areas include mining exploration activities, timber, vegetation and fuels treatment projects, recreation use, fuel-wood gathering, watershed improvement projects, development, Christmas tree cutting, and road and right-of-way management. Appendix D includes the Cumulative Effects list by project name, year, acres, and treatment type. Each of these activities in some way are associated with risk of the direct, indirect and/or cumulative dispersal and propagation of weeds, typically through transporting seeds or providing seed bed opportunities. However, most of these activities do not contribute to the overall cumulative watershed effects from the proposed treatment of the Rush Skeleton Weed project.

Project Design Standards and Monitoring

Project Design Standards

Project design standards were developed for the Proposed Action. Design standards are developed to reduce or eliminate impacts related to analysis issues and affected resources areas, and are incorporated as an integrated part of the Proposed Action.

While developing the design standards for the Proposed Action, the following soil, riparian conservation area, special aquatic feature and herbicide characteristics were considered:

- Soils with soil drainage of somewhat excessive to excessively drained.

Soils with a permeability of moderately rapid or rapid.

Soils with a lithic or para-lithic contact (soil depth of less than 12 inches to bedrock) or a soil with a depth to bedrock of less than 20 inches.

- Soils with an erosion factor K rating of 3.0 or greater.
- Soils having maximum erosion hazard ratings of high to very high, and those with a runoff potential rating of high to very high.
- Distance to high water mark of streams, lakes, ponds, springs and meadows from the application of herbicides
- Mobility of herbicides and considering the method of application within 100 feet of high water mark of streams, lakes, ponds, springs and meadows (herbicide).

The project design standards pertinent to soil and water resources are listed below under Table 23. The design standards provide sideboards for early detection/rapid response. The analysis assumes no treatment zones and treatment zones approximate horizontal (map) distances. For a description of monitoring associated with this project can be found in the Water Quality Monitoring Plan in Appendix F.

Table 23 Project Design Standards for Soil and Water Resources.

Design Standard	Soil and Water Design Standard	Purpose of Design Standard	Source of Design Standard
DS-1	Proposed herbicides will only be sprayed onto target plants within 15 feet of live water. Select application of herbicides will be allowed within 10 feet of live water.	To minimize risk of surface water contamination in order to protect water quality and aquatic organisms.	BMP 5-12: Streamside Wet area Protection during Pesticide Spraying (R5-FSHB 2509.22)
DS-2	When applying herbicides with a backpack sprayer all directed spray will be done in a downward direction in accordance to the herbicide's label. This will minimize herbicide drift and confine the herbicide to the drop zone of the individual weed plant being treated.	To control drift within the entire project area especially within sensitive areas and near water.	BMP 5.12: Streamside Wet area Protection during Pesticide Spraying (R5-FSHB 2509.22) BMP 5-13: Controlling Pesticide Drift During Spray Application (R5-FSHB 2509.22)
DS-3	All herbicide application will follow EPA approved label directions in regards to control of drift of herbicides during spraying. These directions have specific wind speeds and air temperatures for application of each herbicide. Applicators will utilize droplet size and spray pressure to insure droplets do not travel outside of the drip line target plant. A colorant would be added to the herbicide mixture prior to spraying. Spray cards may be used to aid in detecting herbicide drift.	To control drift of herbicides onto unintended targets and to minimize risk of surface water contamination.	BMP 5.8: Pesticide Application According to Label Directions and Applicable Legal Requirements (FSHB 2509.22) BMP 5.9: Pesticide Application Monitoring and Evaluation (R5-FSHB 2509.22) BMP 5.13: Controlling Pesticide Drift during Spray Application (R5-FSHB 2509.22)
DS-4	Areas with bare soil created by the treatment of noxious weeds would be evaluated for rehabilitation (i.e. reseeding,	To ensure that the treatment of noxious weeds	BMP 5.4: Revegetation of Surface-disturbed Areas

	mulching, etc.).	is not creating open areas or bare areas for spread of noxious weeds and to protect water quality and riparian habitat.	(R5-FSHB 2509.22) Watershed and Air Management, Soil Management (FSM 2500, Ch.2550)
DS-5	Herbicide mixing will not occur within 150 feet of surface waters, except at existing facilities. The cleaning and disposal of herbicide containers will be done in accordance with Federal, State, and local laws, regulations, and directives.	To reduce risk of contamination of water by accidental spill.	BMP 5.10: Pesticide Soil Contingency Planning (R5-FSHB 2509.22) BMP 5.11: Cleaning and Disposal of Pesticide Containers and Equipment (R5-FSHB 2509.22)
DS-6	Within 50 feet of perennial or seasonal streams, if treatment reduces groundcover to less than 50% of what is was prior to treatment for a contiguous area of >0.25 acres, then mulching and/or revegetation may be required to minimize erosion and reestablish native vegetation. Only native plant species will be used in revegetation. All mulch and seed material will be certified weed-free.	To ensure that the treatment of noxious weeds is not creating open areas or bare areas for spread of noxious weeds and to protect water quality and riparian habitat.	BMP 5.4: Revegetation of Surface-disturbed Areas (R5-FSHB 2509.22) Watershed and Air Management, Soil Management (FSM 2500, Ch.2550)
DS-7	POEA surfactants will not be used within 150 feet of live waters.	To protect aquatic organisms.	BMP 5.12: Streamside Wet area Protection during Pesticide Spraying (R5-FSHB 2509.22)
DS-8	Herbicide use buffers have been established for streams and other water bodies (listed in Table 3). Buffers vary by herbicide and application method.	To minimize risk of surface water contamination in order to protect water quality and aquatic organisms. To protect water quality and meet SNFPA Riparian Management Objectives	BMP 5.12: Streamside Wet area Protection during Pesticide Spraying (R5-FSHB 2509.22)

These design standards are assumed to protect the treatment areas presently inventoried as well as new or previously undiscovered infestations within the analysis area that would be treated using the range of methods described in detail in the Proposed Action. Herbicide use would become more restrictive as proposed treatments occur closer to water. Design standards and treatment zones within RCAs were developed based on label advisories, interdisciplinary team discussions, SERA risk assessments and other resources.

Monitoring

The Best Management Practices (Appendix E) and the Water Quality Monitoring Plan (Appendix F) provide details of the monitoring approach that will be used for both implementation and effectiveness monitoring. Implementation monitoring would determine whether the selected alternative was implemented as directed, and whether the objectives and priorities were realistic and achievable. Effectiveness monitoring would determine if the treatments were effective in meeting the planned objectives.

Environmental Consequences

Alternative 2 (Proposed Action)

The Proposed Action would treat rush skeleton weed on approximately 1.1 acres and would include identification and treatment of new or expanded infestations on a maximum of 42 acres. Two treatment methods are proposed: chemical and manual. They would both be used but at different times. Treatments would continue for a maximum of 10 years.

Chemical Treatment

The Beckwourth Ranger District of the Plumas National Forest proposes to use formulations of the herbicide aminocyclopyrachlor + chlorsulfuron (e.g. Perspective™) or Aminopyralid + Triclopyr (e.g. Capstone™ or Milestone Plus®) in this project under Alternative 1 (Proposed Action).

All rush skeleton weed plants would be sprayed with aminocyclopyrachlor + chlorsulfuron (e.g. Perspective™) or aminopyralid + triclopyr (e.g. Capstone™ or Milestone Plus®) or a combination of these herbicides. A surfactant (e.g. methylated seed oil) and a locating dye (e.g. Spymax) would be added to the herbicide. All herbicide application would be done with a backpack sprayer. Application methods would include select, directed spray, or wicking. No aerial application of herbicides is proposed in this project. Treatment would occur two or three times per year. The first treatment would occur in rosette stage before any plants have produced viable seeds. Later treatments would be done in late-summer or early fall; new basal rosettes normally appear after the first rain of September or October and can be treated effectively at that time. The maximum application rates are shown below in Table 24. The project area and the access routes would be searched prior to treatments and outer boundary of the infestation would be clearly marked.

Table 24 Proposed Herbicide Application Rates.

Herbicide	Application Rates (a.e.)
Aminocyclopyrachlor (DuPont Method 240SL®)	0.12 to 0.19 lbs/acre
Chlorsulfuron (Telar®)	0.047 to 0.08 lbs/acre
Aminopyralid (Milestone®)	0.075 lbs/acre
Triclopyr (Garlon 3A®)	1 lb/acre

In addition to the specific herbicides, the surfactant methylated seed oil and a colorant dye would be added to mixtures. Methylated seed oil is a spreader/activator that improves the activity and penetration of the herbicide by reducing surface tension, allowing the herbicide mixture to spread evenly over the surface of the vegetation. The colorant or locating dye would be added to indicate where the herbicide has been applied. Treatment by hand-pulling, digging or tarping may be done at any time during the year, if necessary, to remove plants that would not be promptly sprayed with herbicides.

Manual Treatment

Treatment by hand-pulling, digging or tarping may be done at any time during the year, if necessary, to remove plants that would not be promptly sprayed with herbicides. Treatment areas would be re-vegetated with native grasses to provide competition with and prevent reestablishment of rush skeleton weed. Species proposed for rehabilitation of the project area include: mountain brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), and deer vetch (*Acmispon americanus* var. *americanus* formerly known as *Lotus purshianus*). Other native grass and forb species may be substituted for the aforementioned grasses depending on availability.

Alternative 1 (No Action)

Under Alternative 1, the existing condition would be maintained, and the Beckwourth Ranger District Rush Skeleton Weed project would not be implemented. The rush skeleton weed infestation in the project area would not be treated with herbicides. As explained in the EA the existing infestation would be likely to spread. This alternative provides an environmental baseline for evaluation of the Proposed Action.

Effects on Water & Soil Resources from Alternative 2 (Proposed Action)

Proposed Herbicides, Inerts, Seed Oil, and Marker Dye

Aminocyclopyrachlor

The U.S. EPA has developed human health benchmarks and chronic reference doses[6] (RfD) for 363 pesticides in order to better determine whether the detection of a pesticide in drinking water or source waters for drinking water may indicate a potential health risk (U.S. EPA/OPP 2014). The U.S. EPA's chronic or lifetime human health benchmark for aminocyclopyrachlor is 2,450 parts per billion (ppb) and RfD is 0.350 mg/kg/day.

The potassium salt of aminocyclopyrachlor rapidly dissociates to the acid with the addition of water prior to application. All fate information herein is therefore for the acid form. Aminocyclopyrachlor is a persistent compound that will degrade primarily via photolysis post application. It slowly degrades by aerobic microbial metabolism with half-lives ranging from 114-433 days in soils and 29-168 days in water. It is stable to degradation via other pathways. In a silt loam soil from California, the observed half-life of aminocyclopyrachlor acid in the system was >120 days with no major transformation products.

Aminocyclopyrachlor is also expected to be highly mobile in the environment. The solubility of aminocyclopyrachlor ranges from 2,810-4,200 mg/L. This product may impact surface water quality due to runoff of rainwater. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having high potential for reaching surface water via runoff for several months after application. A level well-maintained vegetative buffer strip between areas to which this product is applied, and surface water features such as ponds, streams, and springs will reduce the potential loading of aminocyclopyrachlor from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours.

Aminocyclopyrachlor has properties and characteristics associated with chemicals detected in groundwater. This chemical may leach into groundwater if used in areas where soils are permeable,

6 Reference Dose (RfD): An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

particularly where the water table is shallow. Given the low binding strength to soils and longer half-lives, there are concerns regarding the use of aminocyclopyrachlor acid in certain environments.

Cyclopropanecarboxylic acid is an environmental degradate of aminocyclopyrachlor that the U.S. Environmental Protection Agency/ Office of Pesticide Programs (EPA/OPP) has identified as a metabolite of concern (U.S. EPA/OPP, 2010a). Exposures to cyclopropanecarboxylic acid will occur primarily as a result of the aqueous photolysis of aminocyclopyrachlor. The exposure scenarios used for cyclopropanecarboxylic acid involve only those scenarios associated with contaminated surface water, which is consistent with the exposure assessments developed by the EPA (U.S. EPA/OPP, 2010). The acute and chronic RfDs[7] for cyclopropanecarboxylic acid are substantially lower than the acute and chronic RfDs for aminocyclopyrachlor (SERA, 2012).

Aminocyclopyrachlor does not degrade directly to cyclopropanecarboxylic acid but follows a series of pathways involving the formation of several other metabolites. Very little information is available on the environmental fate of cyclopropanecarboxylic acid (U.S. EPA/OPP, 2010). In the Forest Service risk assessment, Estimation Program Interface (EPI) Suite was used to estimate physical properties and environmental fate parameters for cyclopropanecarboxylic acid. EPI Suite is a computer program developed by U.S. EPA for estimating several environmental fate properties for environmental contaminants. The half-life for cyclopropanecarboxylic acid in water is estimated to be 8.7 days. The expected peak concentration of cyclopropanecarboxylic acid following an accidental spill is about 0.012 (0.00012 to 0.047) mg/L.

Chlorsulfuron

The U.S. EPA's chronic or lifetime human health benchmark for chlorsulfuron is 140 ppb and RfD is 0.020 mg/kg/day (U.S. EPA/OPP, 2014). Degradation half-lives of chlorsulfuron in soil environments range from 14 to 320 days. Its half-life is much longer in soils with high pH. Chlorsulfuron degrades rapidly in a silt loam soil (pH 6.4) at 25°C under aerobic laboratory conditions through hydrolysis and microbial degradation. At a pH of more than 8 there is little hydrolysis and only microbial breakdown. However, microbial processes appeared to be most important in the period immediately following application, but then became less important to the dissipation mechanism, especially under field conditions (Joshi et al., 1985). Breakdown is most rapid in warm, moist, acid and light textured soils with high organic matter. The persistence of chlorsulfuron increased with increasing soil depth, which can be attributed to the decline in the microbial population down the profile (Sarmah et al., 1998).

Chlorsulfuron may be susceptible to direct photolysis. However, little is naturally degraded through this process. It may also be transported to non-target areas by runoff and/or spray drift. Degradation by hydrolysis appears to be the most significant mechanism for degradation of chlorsulfuron, but is only significant in acidic environments (23 day half-life at pH = 5); it is stable to hydrolysis at neutral to high

[7] Acute Reference Dose is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure for an acute duration (24 hours or less) to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. As distinguished from acute, chronic is having a persistent, recurring or long-term nature.

pH. If released into water, chlorsulfuron is not expected to adsorb to suspended solids and sediment. Strict use restrictions would be applied to minimize spray drift for all chlorsulfuron products.

Chlorsulfuron is susceptible to being highly mobile in the environment depending upon soil type. Mobility also usually increases with increasing soil pH and decreasing organic matter. It will move in any direction in the soil profile depending upon water flow. However, it is not expected to cause ground water contamination problems due to its relatively rapid degradation in plants and soils, low use rates and low toxicity.

Aminopyralid

The U.S. EPA's chronic or lifetime human health benchmark for aminopyralid is 3,500 ppb and RfD is 0.500 mg/kg/day (U.S. EPA/OPP, 2014). Because aminopyralid is a new pesticide, very little information on aminopyralid is available in the open literature. No published studies on the toxicity of aminopyralid were identified in searches of TOXLINE (http://toxnet. nlm.nih.gov/) or the AGRICOLA (http://agricola.nal.usda.gov/) at the time that this document was written.

Aminopyralid is quite soluble, and its persistence in soil can vary depending on soil type and other environmental conditions. Its half-life in water can range from 0.6 to 990 days and 20 to 60 days in soil with minimal leaching potential below 15 to 30 cm soil depth. Although aminopyralid does not bind readily in soil, it dissipates rapidly in some common soil conditions. No known metabolites of aminopyralid have been identified (SERA, 2007).

The projected maximum concentrations of aminopyralid under the proposed application rate would be far below potentially toxic levels on soil micro-organisms. A 2007 study by McMurray showed modest increases in nitrate and total mineral nitrogen concentrations in soil directly following application but no statistically significant effects were noted thereafter (McMurray, 2002). The information on soil-micro-organisms is limited and consists only of a no-observed-effect concentration (NOEC) value for earthworms reported as 5,000 ppm (mg a.e./kg soil). The proposed maximum application rate of 0.1 lbs a.e./acre corresponds to a concentration of about 0.05 ppm and "indicates inconsequential risks to earthworms" (SERA, 2007). Consequently, this information does not provide any basis for asserting that adverse effects on soil-micro-organisms are plausible.

Triclopyr

The U.S. EPA's chronic or lifetime human health benchmark for triclopyr is 350 ppb and RfD is 0.050 mg/kg/day (U.S. EPA/OPP 2014). The 2011 SERA risk assessment report done for triclopyr states that there are two basic formulations of triclopyr, a triethylamine salt (TEA) and a butoxyethyl ester. The triethylamine salt formulation of triclopyr would be used for the Rush Skeleton Weed project under Alternative 2.

Triclopyr was reported to have a field half-life of 40 to 46 days in soil, a water solubility rating that ranges from 440 to 8,220 mg/L, and an intermediate to minimal leaching potential. Triclopyr appears to variably persist in soil, with minimal mobility and minimal leaching evident in field studies. Triclopyr is adsorbed primarily to organic matter particles in soil. The organic matter content is the primary factor in the degree of soil adsorption and is not characterized as strong (SERA, 2011).

As was discussed with aminopyralid, the toxicity data on soil-micro-organisms is also limited with triclopyr. The projected maximum concentrations under the proposed application rates would be far below potentially toxic levels, therefore the potential for substantial effects on soil-micro-organisms appear to be low (SERA 2011). A study by McCormac (2010) suggest that triclopyr (TEA formulation) may be moderately toxic to earth worms while a study by Potter et al. (1990) suggested that when applied at a rate of 0.36 lb a.e./acre there was no significant reduction in mixed earthworm populations. Additionally, Houston et al. (1998) notes that triclopyr had no impact on soil microbial function or community structure at an application rate of 1.2 lb a.e./acre. Consequently, this information does not provide any basis for asserting that adverse effects on soil–micro-organisms are plausible.

A concern in the 2011SERA risk assessment completed for triclopyr is 3,5,6-Trichloro-2-pyridinol (TCP) because it is a major environmental metabolite of triclopyr. TCP is formed in all relevant environmental media, as a metabolite in plants, soil, and water. No information is available on the half-life of TCP, which is assumed to be identical to that of triclopyr. The water solubility of TCP is somewhat less than that of triclopyr (i.e., 100 vs 400 mg/L). The estimated soil sorption for TCP is substantially greater than that of triclopyr (i.e., 1000 vs 0.35). While there is little indication that TCP poses a substantial risk to humans, this metabolite is more toxic than triclopyr by a factor of about 40, based on acute toxicity, and by a factor of 180, based on chronic toxicity (SERA, 2011). The acute and chronic reference doses for TCP are lower than those for triclopyr. There is a substantial body of monitoring data for TCP concentrations in surface water following aquatic applications of triclopyr (SERA, 2011). Conversely, there appear to be no monitoring data for TCP concentrations in surface following terrestrial applications of triclopyr.

The Herger Feinstein Quincy Library Group (HFQLG) Final Supplemental Environmental Impact Statement (EIS) analyzed the likelihood of detection of triclopyr in surface waters following backpack spray application methods and with full implementation of all water quality best management practices. A few of the dozen samples collected for forestry projects in the Sierra Nevada and North Coast Region of California had detectable concentrations of triclopyr. None of the sampled concentrations had an Acute Human Health Benchmark[8] (HHB) for triclopyr value of 1,650 ppb or greater nor a Chronic or Lifetime (HHB) value of 350 ppb suggesting a very low risk that ground based application of triclopyr, with buffers and execution of other BMPs, would result in triclopyr concentrations exceeding the HHB (EPA, 2014a). The HFQLG Final Supplemental EIS concluded that with establishment of adequate streamside buffers and ground application, and absent direct application onto surface waters, triclopyr concentrations in surface waters are typically not detected in forestry applications. Little is known about triclopyr concentrations in ground waters in forested areas, although a recent survey of ground waters in primarily

[8] Human Health Benchmarks for Pesticides (HHBPs) were established for acute and chronic effects. EPA used the acute and chronic reference doses (RfDs) established for the most sensitive life stage/population. EPA applied standard drinking water exposure assumptions that are used in calculating health advisories. EPA has updated its Human Health Benchmarks for Pesticides (HHBPs) in drinking water to reflect the latest scientific information. HHBPs are levels of certain pesticides in water at or below which adverse health effects are not anticipated from one-day or lifetime exposures.

agricultural and urban areas at over 2,600 sites across the United States did not detect triclopyr (USDA, 2003).

Inerts

The formulation of the proposed herbicides used by the Forest Service contains other materials that are included to improve either efficacy or ease of handling and storage. The identity of these materials is confidential. The inerts were disclosed to the U.S. EPA and were reviewed in the preparation of SERAs. All that can be disclosed explicitly is that none of the additives are classified by the U.S. EPA as toxic (EPA, 2014b).

Seed Oil & Marker Dye (Colorant)

The proposed use of herbicides includes the additional use of seed oil as a surfactant and a marker dye. Surfactants are used to facilitate or enhance the absorbing, emulsifying, dispersing, spreading, sticking, wetting, or penetrating properties of herbicides. The surfactant to be used is an esterified vegetable oil surfactant. The assessment of hazards related to surfactants is limited by the proprietary nature of the formulations. Surfactants, by their very nature, are intended to increase the effect of a pesticide by increasing the amount of pesticide that is in contact with the target. This is not synergistic, but more accurately a reflection of increased dose of the herbicide active ingredient into the plant.

The marker dye (i.e. colorant) will be added to the herbicide mixtures prior to the application so that the actual treated area can be readily determined. This helps to prevent skips and overlaps. The colorant is a water-soluble dye that contains no listed hazardous substances. It is considered to be virtually non-toxic to humans. Its effect on non-target terrestrial and aquatic species is unknown, however its use has not resulted in any known problems.

The “Analysis of Issues Surrounding the Use of Spray Adjuvants with Herbicides” (Bakke, 2007) cites technical references which indicate a lack of synergistic effects between surfactants and pesticides which suggest that surfactants don’t increase the toxic effects of herbicides. This paper also listed the results of standard acute aquatic species toxicity testing which indicated that any potential effects to aquatic species would be unlikely under normal application rates. Studies have shown that mobility of materials throughout the soil profile is a function of the concentration of the surfactants in the soil solution. For this to occur, concentrations of surfactant must be high, in the range of 1,000 ppm or more. This level is unlikely to be reached under normal application rates as proposed by this project, which would likely have concentrations considerably less than 12 ppm. “Although the potential exists for surfactants to affect the environmental fate of herbicides in the soil, any potential effects would be unlikely under normal conditions because of the relatively low concentration of surfactants in the soil/water matrix. Localized effects could be seen if a spill occurred on the soil, so that concentration of surfactant approached or exceeded about 1,000 ppm” (Bakke, 2007).

Direct and Indirect Effects from Alternative 2

A primary direct and indirect effect associated with Alternative 2 is the potential for herbicides to enter streams and impact aquatic organisms. The effect of chemical and manual treatments may also affect soils directly by having short-term adverse impacts on certain soil microbes and indirect impacts from losses in vegetative cover. In general, herbicides decay over time; therefore, effects are reduced when microbial metabolic rates are at their highest.

The effect of a chemical treatment on the soil depends on the particular characteristics of the chemical used, how it is applied, and the physical, chemical, and biological condition of the soil medium. Primary herbicide routes in soil are mainly through leaching, hydrolysis, and adsorption/desorption onto soil particles, and biological degradation. Soil characteristics affect the herbicide residency time through drainage and adsorptive capacities. Highly drained soils have greater propensity to transfer herbicides to groundwater stores. Organic rich soils and finer texture soils have higher adsorption potential for holding herbicides. Herbicides will vary in the degradation potential based on their chemical structure and the biologic potential of the soil.

The low application rates of the herbicides proposed in general are expected to have a low impact on soil organisms. However, if applied at higher rates that are beyond the amounts proposed, these herbicides could potentially affect soil microbes and may adversely affect some fungi and algae. Effects from the proposed herbicide treatment are expected to be short term and transitory since effects decrease with time as the herbicides degrade. Functional groups of microbes that have similar metabolic pathways as the target weeds would be most sensitive to the herbicides. However, collective adverse effects of the proposed herbicides on soil microbes are hard to predict, given the diversity of the soil community and varying resistance to the particular herbicides.

The treatment of sites with herbicides could also indirectly affect site productivity in the short term through changes in total organic production on site and annual input into the soil. Chemically treated plants would die and become incorporated into the soil as organic matter during the first years following treatment. Annual input in subsequent years would be limited by the number of non-target species interspersed between invasive plants or the rate at which vegetation returned to the site.

Herbicide degradation over time is a result of physical and chemical processes in soil and water. Herbicide fate in soil is determined by herbicide characteristics such as mobility, adsorption, solubility, degradation, and volatility. Soil characteristics such as organic matter, pH, temperature, moisture content, clay content, and microbial degradation can modify certain properties of herbicides in the environment.

Deleterious effects are avoided primarily by the low dosage and selected type of herbicide. Offsite percolation into groundwater and runoff of herbicides is reduced by the low application rates and dictated by the amount of precipitation. The primary degradation pathways of herbicides include decomposition by soil organisms, light (photolysis), and water (hydrolysis). The degree herbicides persist in soil is a function of the productive capacity of soil.

The low rate of application of the selected herbicides is not expected to have detectible toxic effects on soil organisms using the SERA risk assessment findings (SERA 2004, 2007, 2011, and 2012). Impacts to soils and soil microbial community would largely be secondary, related to removal of targeted vegetation and shift to desired plant species. Changes in vegetation type can shift below ground composition of soil organisms (Wardle et al., 2004). Indirect boosts in decomposition rates may result as the soil microbes respond to the increased available carbon. Slight increases in microbial activity may occur as the bacteria breakdown the herbicide.

The overall impacts of manual treatment are also expected to be very limited and of little effect to soil and overall water quality. These methods would temporarily decrease ground cover, potentially leading to incremental effects from erosion or slight decreases in soil moisture from ground cover reductions. These methods would also loosen small amounts of soil at the surface, potentially increasing the chance of localized erosion. Erosion is expected to be very minor and temporary effect and changes would be within the natural range of variability because of the small size, sporadic nature, location and gentle slopes of the rush skeleton weed sites within the project analysis area.

Risk for offsite transport by wind is low due to the backpack application which covers only small areas at a time. Adverse risks to soil microbes were not identified since application rates are low; none of the selected herbicides have known adverse effects on soil microbes at these rates.

Concentration of Chemicals

Transport processes of herbicides include atmospheric drift, foliar and stem wash-off, plant uptake, soil leaching, volatilization, surface runoff, and subsurface flow (Neary et al., 1993). The interaction of precipitation and evaporation, as forces driving herbicide movement, with other climatic factors, degradation processes, soil-water properties, and the characteristics of individual herbicides, makes site-specific prediction of the behavior of herbicides very difficult (Michael and Neary, 1993). Herbicides most likely to contaminate waters through leaching and runoff have the following properties: low absorptivity to soil, relatively high water solubility, slow degradation rate, and high application rate (Green et al., 2001). However, variations in temperature, soil acidity, and other chemical conditions, along with physical site conditions like depth to groundwater, preclude simple generalizations about the degradation and transport of herbicides through soil to surface and ground waters (USDA, 2003).

Organic matter with high cation exchange capacity (CEC) strongly affects movement of chemicals in the soil, depending also on pH level. Amount and intensity of precipitation generally dictates total chemical solubility and potential movement. Ground cover modifies precipitation infiltration into the soil and provides a medium for holding chemicals above ground. Herbicide that falls onto the soil could travel offsite by surface runoff, wind erosion, or groundwater flow. There is elevated risk for surface runoff when soils are bared on steep or compacted ground. Once in soil, herbicide not directly absorbed into plant roots is typically metabolized by microbes (Bollag and Liu, 1990).

Half-life of herbicides in soil is affected by its rate of adsorption to soil particles or organic matter incorporated into the soil. The stronger the adsorption the more likely chemicals will be retained in top soil layers for microbial degradation. Organic matter in particular has an affinity for adsorption.

Degradation proceeds rapidly in presence of sunlight, or by soil microbes when soil moisture is ample. Soil moisture of less than 10% becomes a limiting factor in microbial activity (Davidson et al, 1998). Outside these environments (on the soil surface or within the top few inches of the soil where microbial activity is high) the half-life of herbicides is measured in months. Based upon the properties associated with the proposed herbicides (Table 25) along with the proposed low application rates (Table 24) in addition to adhering to project design standards (Table 23), appropriate BMPs (Appendix E), and Water Quality Monitoring Plan (Appendix F), the proposed herbicides are expected to pose a low risk to the environment.

Table 25 Properties Associated with the Proposed Herbicides (Assuming Application Rates Stated in Table 5).

Herbicide	Water Solubility (mg/L)	Degradation Half-Life (days)		
		Soil	Water	Veg/Fruit
Aminocyclopyrachlor	2,810-4,200	114-433	29-168	93
Chlorsulfuron	27,900-31,800	14-320	23-200	30
Aminopyralid	2,480-248,000	20-60	0.6-990	10.5-16.3
Triclopyr	440-8,220	40-46	0.1-4.3	2.6-73.1

Surface Runoff

Bared soil is susceptible to erosion and overland flow by effects of rainfall. Raindrop impact can be great enough to break down soil aggregates, reducing through physical disintegration surface pore space area and thereby the soil’s infiltration capacity (Moore and Singer, 1990; Cattle et al., 2004). With sufficient wetting of the soil surface dispersion of fine grains will cause a crust to form, a fine grain coating with low permeability. Overland flow is often associated with creation of soil crusts (Esteves et al., 2000; Cerdan et al., 2001; USDA, 2008). Surface sheet flow can carry fine grain soil particles of the order of silts and clays (<0.0625 mm in diameter). Despite mostly high solubility, the herbicide’s very large mass and some attraction to negatively charged soil particles means that transport in water is only likely to occur when attached to soil particles that may be moved by shallow sheet flow.

Resistance to surface flow on most natural surfaces is amply provided by vegetation and ground cover. It is unlikely that whole surfaces of treated areas would be made barren by herbicide treatment, if for no other reason that poisoned plants would provide a dead organic cover on the soil. Further, backpack spraying and direct application allows for selected targeting and reduces kill area that might contribute to bare surface area.

Many of the proposed herbicides may be transported to off-site soil by runoff or percolation. Runoff and percolation are both considered in estimating contamination of ambient water. For assessing off-site soil contamination, however, only runoff is considered. This approach is reasonable because off-site runoff will contaminate the off-site soil surface. Percolation, on the other hand, represents the amount of the herbicide that is transported below the root zone and may thus impact water quality. However, based upon the amount and locations for the proposed chemical treatments, implementation of design standards and BMPs, and proposed application rates it is expected that there will be a low risk of off-site movement.

Treatment on roads does pose a greater risk to eventual surface water contamination because surface runoff from bare and or compacted surfaces within the road prism shed precipitation water more readily and frequently than natural slopes. In a study at Lake Tahoe, Grismer and Hogan (2005a; 2005b) showed runoff from bare road cut slopes have 10 to 50 times the runoff of similar intact native soils. Further and possibly more significant, road prism runoff from running surfaces and cut banks is often facilitated with engineered ditches and relief pipes. To the extent that drainage may lead onto natural slopes, road surface runoff may be buffered. However, road segments that cross streams or penetrate into stream buffers provide routes for contaminants to reach streams, whether from rutted running surface, roadside ditches or runoff projected onto natural slopes an inadequate distance from the channel for proper buffering. Road segments in the project analysis area do not have known populations of rush skeleton weed, but may be treated if populations spread to these sites. All project design standards and appropriate BMPs will be followed.

Groundwater Transport

Herbicides that are highly water soluble or strongly adsorbed to soil particles have the potential to move off site following application, during the half-life period. The proposed herbicides are considered highly soluble in water, i.e. solubility greater than 300 mg/l (Bautista and Bulkin, 2008). Once into solution herbicides may transport through the soil as groundwater flow, potentially reaching natural surface water bodies. However, as groundwater is dispersed through a soil there is also increasing chance that chemicals will adsorb to the soil. The depth of a wetting front for precipitation events following herbicide application marks the probable depth of penetration of chemicals and an accumulation zone from additional applications of herbicides.

Direct foliar application lowers offsite effects for leaching. If rainfall occurred during application, or within the first day after application the risk for excessive leaching exists for all the herbicides considered (Appendix E, BMP: CHEM-1). Runoff risk is particularly high for saturated soils during snowmelt, because of low infiltration capacity. Spraying in spring when soil moisture is high and groundwater flow active may pose greater risk to transport of chemicals than in early fall when soil moisture content is very low, even under the same conditions of precipitation. Chemicals move into the soil with infiltrating precipitation, but depth of initial movement is important. A contaminated wetting front that stops in the top few inches of the soil, in the zone of microbial activity, would degrade faster. Herbicides infiltrating into soil with high water content and active gravity flow may quickly percolate beyond the range of most soil biota that would reduce the chemical. Herbicide half-life (the time it takes half the chemical to degrade), increases sharply when in groundwater. Based upon the properties associated with the proposed herbicides along with the proposed low application rates in addition to adhering to project design standards (Table 23), appropriate BMPs (Appendix E), and Water Quality Monitoring Plan (Appendix F), the proposed herbicides are expected to pose a low risk to the environment. Additionally, as mentioned in the Water Quality Monitoring Plan (Appendix F) application of the proposed herbicides will be restricted from the beginning of June to the end of September as the only time of year to chemically treat the rush skeleton weed sites since it would potentially have the least effect on soils and water quality, including ground water (WQMP Appendix F).

Accidental Spill

Concentrations of herbicides in the water as a result of an accidental spill depend on the rate of application and the stream ratio of surface area to volume. The persistence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly downstream because of dilution and interactions with physical and biological properties of the stream system. A safety and spill management plan is a project requirement. This plan addresses spill containment. The safety and spill management plan can be found in Appendix C.

SERA Risk Assessment Worksheet Results

SERA risk assessment "worksheets" were developed for each of the proposed herbicides based upon proposed application rates for Alternative 2 (Table 26, Table 27, Table 28). The results of these worksheets were used to assess the potential contamination and concentration of herbicide application to water. They are an overestimate of the amount of herbicide concentrations that would plausibly enter most streams due to default settings and have not been adjusted to site-specific conditions (e.g. model also assumes herbicide application along streams versus other direct application methods such as hand wicking, etc.).

Table 26 Estimates of Water Contamination_Rates (i.e., the concentration in ambient water per pound applied per acre).

	Short-term peak concentrations (mg/L)		Longer-term average concentrations (mg/L)	
Herbicide	**Upper**	**Lower**	**Upper**	**Lower**
Aminocyclopyrachlor	0.7	0.002	0.35	0.0009
Chlorsulfuron	0.2	0.01	0.0009	0.0001
Aminopyralid	0.6	0.002	0.26	0.001
Triclopyr	0.24	1E-06	0.06	2E-10

Table 27 Expected Concentrations in Surface Water.

	Short-term peak concentrations (mg/L)		Longer-term average concentrations (mg/L)	
Herbicide	**Upper**	**Lower**	**Upper**	**Lower**
Aminocyclopyrachlor	0.133	0.00038	0.0665	0.00017
Chlorsulfuron	0.016	0.008	0.000072	8E-05
Aminopyralid	0.045	0.00015	0.0195	7.50E-05
Triclopyr	0.24	1E-06	0.06	2E-10

Table 28 Concentration in Stream Water after Direct Spray or After Drift from Backpack Directed Foliar Application at Distances Downwind in Feet from the Application Site.

Herbicide

Direct Spray Buffer (ft)	Aminocyclopyrachlor (mg/L)	Chlorsulfuron (mg/L)	Aminopyralid (mg/L)	Triclopyr (mg/L)
0	0.017356621	0.007308051	0.006851298	0.0913506
25	0.000144407	6.0803E-05	5.70028E-05	0.00076
50	7.51542E-05	3.16439E-05	2.96661E-05	0.0003955
100	4.18295E-05	1.76124E-05	1.65116E-05	0.0002202
300	1.63326E-05	6.87688E-06	6.44707E-06	8.596E-05
500	1.00495E-05	4.23136E-06	3.9669E-06	5.289E-05
900	5.41527E-06	2.28011E-06	2.1376E-06	2.85E-05

Note: These calculations assume the application rates specified in Table 5, a stream flow rate of 710,000 L/day, stream length of 1,038 feet, and stream width of 6 feet.

The California Code of Regulation (Title 22, Division 4, and Chapter 15) does not have formal standards for water quality for any of the herbicides proposed in Alternative 2 of this project. Instead researched toxicity levels were used as a means of assessing the concentration risk to organisms. Risk assessment documents produced by SERA and based on the comprehensive reports (SERA 2004, 2007, 2011, and 2012) have listed concentration levels deemed at acute or chronic toxicity for various organisms potentially at risk from water contamination. Table 29 lists these thresholds. It can be seen with a comparison of Tables 8 and 9 that concentrations from the model runs are typically many orders of magnitude less than thresholds of concern for fish and aquatic invertebrates.

Table 29 Toxicity Levels of Proposed Herbicides for Aquatic Organisms.

	Level of Concern for Acute Poisoning (mg/L)			
	Fish		Aquatic Macro-invertebrate	
Herbicide	Sensitive	Tolerant	Sensitive	Tolerant
Aminocyclopyrachlor	---	120	3.7	122
Chlorsulfuron	30	300	10	35
Aminopyralid	50	100	89	99
Triclopyr	20	210	25	320

Berg (2004) in a comprehensive review of Best Management Practices associated with herbicide spraying in Region 5 and elsewhere in the United States found similar results. Detectable levels of herbicides such as Glyphosate, Triclopyr, and Clopyralid were found in various locations (Washington, Oregon, New York and Florida) mainly as a result of drift from boom broadcast spray or aerial application, which neither of these treatments are proposed with this alternative. An Oregon Department of Transportation study sampled runoff from road shoulders after treatment of Glyphosate, with no buffers on a stream. Under simulated rainfall of high intensity they found 100's of ppb could be transported off site. In a similar test, under natural rainfall 0.1-1 ppb was detected leaving the road prism. The results of these studies along with the results of the SERA worksheets, and implementation of project design standards, appropriate BMPs, and the Water Quality Monitoring Plan support the conclusion that the proposed herbicide treatments are expected to pose a low risk to beneficial uses of water within the watershed analysis area.

Summary of Indirect and Direct Effects

The Proposed Action (Alternative 2) is not expected to have an influence on stream flow or channel morphology due to the Proposed Actions and the small portion of any watershed that would be treated. Treating invasive plants would improve riparian stability where invasive plants have colonized along stream channels and out-competed native species. All invasive plant treatments carry some risk that removing invasive plants could exacerbate stream instability. However, these areas will be either mulched or reseeded or some combination of the two as needed to revegetate the riparian corridor and other treated areas as specified under design standard 4 and 6 (DS-4 and DS-6) (Table 4).Small areas or pockets of rush skeleton weed would be treated along both perennial drainages of Jamison and Eureka Creeks within the project analysis area. Less than one acre of chemical treatment is proposed in RCAs within the project analysis area. Treatment is expected to be discontinuous and limited at any one site. As the rush skeleton weed provide little shade, removal of these plants is unlikely to have any measurable effect to stream temperature. The occurrence of manual treatment near streams could cause a minor loss of ground cover and soil disturbance leading to erosion and a minor localized increase in fine sediments particularly if vegetation is removed from streambanks. This increase is not considered significant as it is only expected to last a season or two until vegetation becomes reestablished. Many treatment sites are small and would reseed naturally with existing native vegetation. It is expected that stream and aquatic feature buffer widths would sufficiently protect water quality. These buffers are considered adequate to minimize herbicide concentrations in water. This is further supported by streamside buffer studies in forested area on NFS lands (USDA, 2001) that show stream buffers greater than 25 feet commonly lower herbicide concentrations below any threshold of concern and often below detectable limits. Coupled with the set project design standards (Table 23), implementation of BMPs (Appendix E) and WQMP (Appendix F), the indirect and direct effects to water is expected to be sufficiently protected from the Proposed Action.

Overall, the proposed herbicides, adjuvants and application rates are low enough to facilitate decay by soil microbes or through hydrolysis. The proposed herbicides and adjuvants usage would have a low risk following design standards (Table 23), appropriate BMPs (Appendix E), and Water Quality Monitoring Plan (Appendix F). Design standards are designed to help protect soils and water quality through the direct spraying or hand wicking of the selected herbicide directly onto the rush skeleton weed plant thereby minimize the amount of herbicide in contact with soil and water.

Manual treatments may slightly increase the potential for delivery of fine sediment to streams the year after treatment. Removal of surface cover could cause minor localized erosion trapped by surrounding vegetation for approximately one season until vegetation becomes reestablished. With appropriate implementation of design standards and BMPs the proposed manual treatment methods are not expected to lead to adverse effects on soils. Additionally, in areas with larger amounts of bare soil reseeding would be considered in order to reestablish native vegetation. The intent is to reestablish competitive local, native vegetation post-treatment in areas of bare ground, to control soil erosion and provide native competition to invasive plants.

Cumulative Effects from Alternative 1

Cumulative effects associated with this alternative are covered under the 2006 Lake Davis Watershed Assessment (WA) (available upon request at the Plumas National Forest, Beckwourth Ranger District Office). The Lake Davis WA used the equivalent roaded acre (ERA) model to calculate cumulative watershed effects for sub-watersheds within the HUC5 Lake Davis watershed. The watershed analysis area for this project consists of Lower Jamison Creek, Upper Jamison Creek, and Bonta Creek HUC7 watersheds. Activities analyzed in the ERA model include past timber and fuels reduction projects, wildland fires, grazing, roads, and development both on public and private lands. All sub-watersheds (Jamison, Eureka, and Squirrel) that are within the watershed analysis area and calculated for the Lake Davis Watershed Assessment are well below the threshold of concern.

Only the land within the project analysis area on National Forest System lands would be treated through the Proposed Action. The National Forest, however, is intermingled with other federal, state, county, and private ownerships within watershed analysis areas. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest System lands, and vice versa. It is unknown the amount, if any herbicide is being applied on other lands outside of NFS lands. To address these uncertainties and to help maintain little to no cumulative effects to the watershed analysis area and to beneficial users downstream, implementation of established design standards, BMPs and project monitoring identified in the water quality monitoring plan are essential. It is expected that the design standards, BMPs, and project monitoring would provide sideboards for maintaining little to no cumulative effects to water and soils.

Very little vegetation would be removed in any watershed therefore none of the treatments are extensive enough under any alternative to effect peak flows, low flows or water yield in any watershed. The project analysis area occupies a small percentage of the entire cumulative effects analysis watersheds. This amount is much too small an area to show effects to flows from treatment. Past, present and reasonably foreseeable future projects are not expected to have any cumulative effects within the watershed analysis area. No adverse cumulative effects are expected from the implementation of the Proposed Action.

Effects on Water & Soil from Alternative 1 (No Action)

Direct, Indirect, and Cumulative Effects

Alternative 1 would not treat any of the rush skeleton weed populations with herbicides or manual treatment. The existing condition would be maintained. Adverse tradeoffs with Alternative 1, in this case, the risk of no treatment, may include impacts to soils from rush skeleton weed plants that are left to populate existing sites and surrounding area. Specific changes to soil may include changes to nutrient regimes, and increased erosion as the possibility of rush skeleton weed displaces native plants, in addition to changes in surface hydrology and streambank stabilization where the plant communities move from one vegetation composition to another. In addition, the greatest adverse risk of not treating existing noxious weed sites would be the potential for rush skeleton weed to spread into relatively undisturbed areas not only within the existing project area, but potentially further down Jamison and Eureka Creeks and ultimately to the Middle Fork of the Feather River corridor downstream of the project analysis area. These tradeoffs are weighed by addressing spread rate versus the impact from treatment, especially in regards to affecting non-target plant species.

As explained in the following two paragraphs the existing infestation would be likely to spread. Previously authorized hand treatment of the infestation would likely continue on an annual basis. Hand treatment would reduce the risk of spread but it is less effective than herbicide treatment because it does not kill plants. Hand treatment is less practical than herbicide treatment because it requires regular repeated visits to the site throughout the growing season to ensure that no plants produce mature seeds.

Activities proposed in the Discovery Mine may be implemented. That proposal is being evaluated in a separate process. If those activities are implemented without implementing the rush skeleton weed project there would be an increased risk of noxious weed spread and infestation. That risk includes creation of new infestations as well as an increase in size and density of the existing infestation.

Wildlife

Affected Environment/Environmental Consequences

General Affected – Terrestrial Environment

Existing condition within the Wildlife Analysis Area is displayed in Table 30. For the comparative analysis contained in this BE/BA, the California Wildlife Habitat Relationships (CWHR) system is used to evaluate habitat conditions and the suitability of wildlife habitat. Table 30 displays all pre-treatment vegetation information currently available within the Wildlife Analysis Area. All vegetation information is displayed using the CWHR vegetation codes (USDA 2014c). The vegetation layer is a composite of remote sensed data and local project specific vegetation data all based on aerial photo interpretation.

Table 30. Summary of all CWHR acres within the Wildlife Analysis Area derived from vegetation layer (all acres are approximate and National Forest System Lands only)

CWHR Type*	Wildlife Analysis Area
BAR	2
DFR4D	16
DFR4M	3
DFR4P	3
DFR5P	3
EPN4P	4
MRI	11
Total	**42**

*4=small 11-24"dbh, 5=medium/large >24"dbh. M = Moderate Canopy 40-59%, P = Open Canopy 25-39%, BAR=Barren, DFR=Douglas-fir, EPN=Eastside Pine, MRI=Montane Riparian.

General Affected – Aquatic Environment

Streams, Critical Aquatic Refuges and Riparian Habitat

The Rush Skeleton Weed project is located in the Lake Davis Hydrologic Unit Code 5 (HUC-5) watershed. Both perennial and ephemeral streams occur within Wildlife Analysis Area (Table 31). Just two perennial streams are located within the Wildlife Analysis Area, Jamison Creek and Eureka Creek. Eureka Creek flows into Jamison Creek which ultimately flow into the Middle Fork of the Feather River approximately 1.4 miles directly downstream of the Wildlife Analysis Area. Both of these creeks support coldwater fisheries, with the principal fish species being rainbow trout, brown trout and speckled dace.

Table 31. Miles of Perennial, Intermittent and Ephemeral Streams and Number of Springs and/or Seeps in the Wildlife Analysis Area

Creeks	Miles
Perennial – Jamison Creek	0.22
Perennial – Eureka Creek*	0.14
Intermittent	0
Ephemeral	0.31
Total Miles	**0.67**
	Numbers
Springs and/or Seeps	3

* Currently Infested Area is only along the Eureka Creek.

The riparian vegetation consists mainly of sedges, willows and alders which vary from sparse to generally abundant along the two perennial streams, providing some shade and bank stability to the stream channels. Riparian habitats support greater diversity and abundance of wildlife species in relation to cover types. These areas function as habitat for vertebrate wildlife and provide corridors for wildlife movement and migration. They act as wildlife refuges during wildfires and are often the first areas reoccupied by wildlife after stand replacing fires. Dense and diverse riparian vegetation provides a large variety and quantity of nest and perching sites, along with food from seeds, fruits, and insects. This habitat supports many insects, birds, mammals, reptiles, and amphibians.

The 2004 amendment to the Sierra Nevada Framework defines two areas of interest: Riparian Conservation Areas (RCAs) and Critical Aquatic Refuges (CARs). The delineations for RCAs are from the Sierra Nevada Forest Plan Amendment (SNFPA) FEIS Record of Decision (USDA, 2004).

Riparian areas would be protected in a manner consistent with the Riparian Conservation Objectives (RCO) and RCA designation and desired conditions. Table 32 outlines project stream and aquatic buffer widths as they relate to the herbicide treatment. Buffers for live water should provide sufficient protection in the event flow is encountered in a channel that is typically of short duration.

Table 32. Stream and Aquatic Features Buffer Widths for Herbicide Application

HERBICIDE ACTIVE INGREDIENT	LIVE WATER (Perennial streams, springs, wetlands, etc.)		NO LIVE WATER (Seasonal wetlands when dry; seasonally flowing / intermittent channels that support a continual strip of riparian vegetation)		Dry washes without riparian vegetation
	Herbicide Application Method				
	Directed spray	Select	Directed spray	Select	No buffer required, unless otherwise specified by project design standards.
Amino-cyclopyrachlor	15 ft	10 ft	15 ft	No buffer required	
Chlorsulfuron	15 ft	10 ft	15 ft	No buffer required	
Aminopyralid	15 ft	10 ft	15 ft	No buffer required	
Triclopyr	15 ft	10 ft	15 ft	No buffer required	

- Buffer distances are measured from the streambank or water's edge.
- Roadside ditches will be treated the same as the water body type they resemble.
- Herbicide application methods are limited to "select" (e.g. wicking, wiping, stem injection, and hack and squirt), and "directed spray" (use of backpack sprayer or hand held nozzle to aim application at specific target species), as permitted by the product label and project design standards. **No broadcast or aerial herbicide applications will occur.**
- Toxicity, soil mobility, and runoff potential were considered in selecting buffer distances and application methods allowed. In some instances, buffer distances are greater than those provided in the product label, in order to comply with USFS Best Management Practices for Water Quality.

The Rush Skeleton Weed Project contains approximately 15 acres out of the total 31,057 acres of the Lakes Basin critical aquatic refuge (CAR) (Figure 6). Critical aquatic refuges (CARs) were developed around:

- known locations of TES species, or
- highly vulnerable populations of native plant or animal species, or
- localized populations of rare native aquatic or riparian dependent plant or animal species (USDA 2001).

The primary role of the CARs is to preserve, enhance, restore or connect habitats for these species at the local level and to ensure the viability of aquatic or riparian dependent species while guiding management activities (USDA 2001).

The Lakes Basin CAR was designated based on historic occupancy of Sierra Nevada yellow-legged frogs in 1977 and 2001. All of these historic occupancy records are approximately 3 and 9 air miles (3.5 to 17 stream miles) away from the Wildlife Analysis Area.

See the Rush Skeleton Weed Project Cumulative Watershed Effects & Soils Assessment Report for further details on soil, stream, and watershed conditions (USDA 2014b).

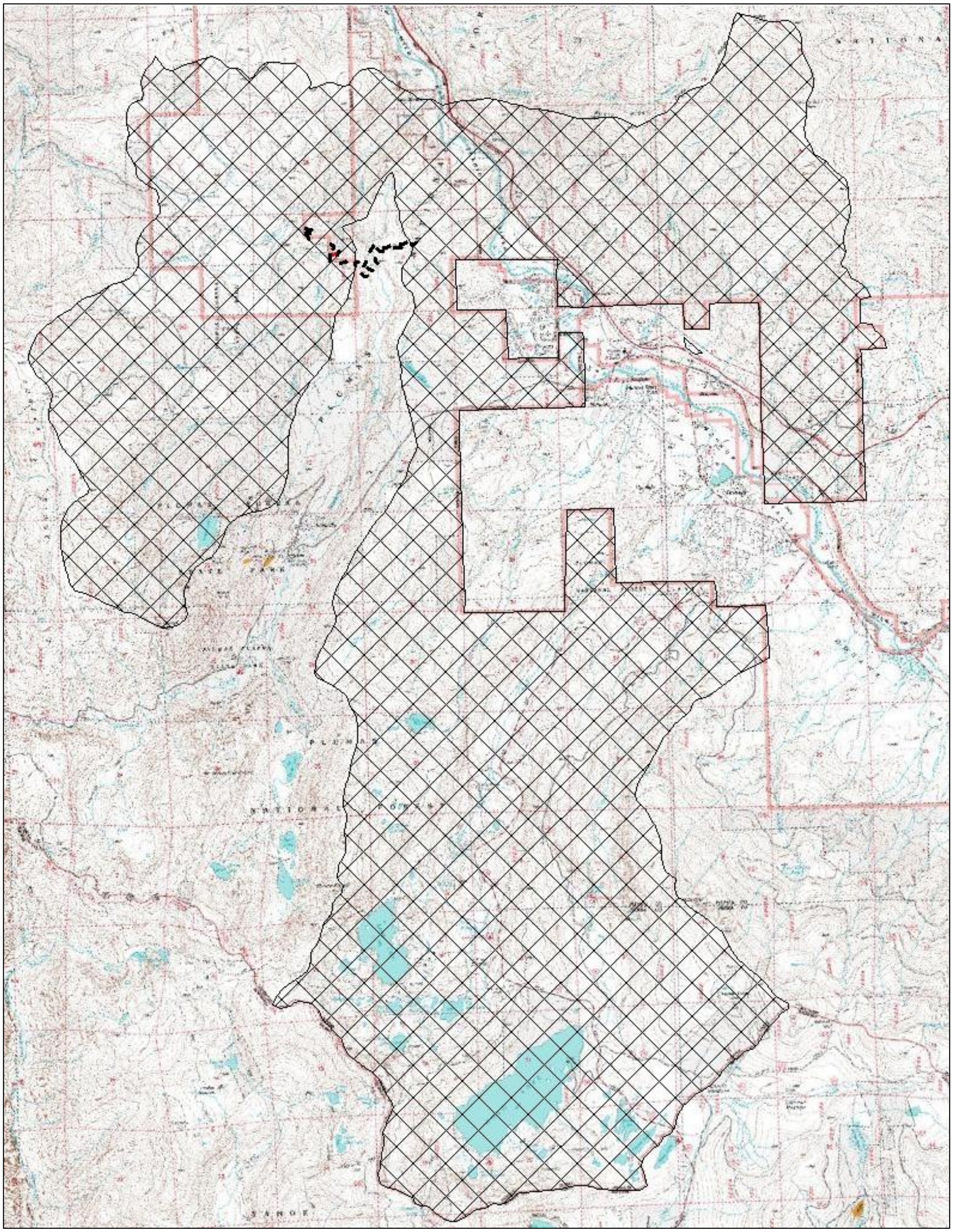


Figure 6Critical Aquatic Refuge (cross hatched line), Wildlife Analysis Area (dashed line) and Currently Infested Area (solid color (red)).

General Environmental Consequences

Direct effects include immediate changes in habitat conditions and disturbance/ harassment to individuals, including direct mortality, during project activities. It is assumed in this analysis the proposed action would be implemented as stated, in compliance with all rules and regulations governing land management activities, including the use of the appropriate Limited Operating Periods (LOP) identified in Table 33. Direct disturbance, including mortality to individual animals addressed in this document is highly unlikely, due to survey efforts for selected species, incorporation of LOP's where appropriate, and implementation of Forest standards and guidelines. Indirect effects include effects that occur later in time or beyond the action area of the project. Indirect effects can also include effects to a species prey base.

Table 33. Limited Operating Periods (LOP's)

Species	Location	Limited Operating Period	Reference Pages
Foothill Yellow-legged Frog	All occuppied habitat	October 1st through April 15th	Professional Judgment
Sierra Nevada Yellow-legged Frog	All occuppied habitat	April 15th thriough October 15th	Professional Judgment
Fringed Myotis, Pallid Bat and Townsend's Big-eared Bat	W/in ¼ mile of maternity and other roosts	April 1st through October 31st	Professional Judgment

Cumulative effects analysis for ESA compliance includes "those effects of future State or Private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation". There are no interrelated or interdependent actions in the Rush Skeleton Weed Project. Under NEPA, cumulative effects represent the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. There are no connected actions in the Rush Skeleton Weed Project.

Herbicides

The analysis of potential effects to wildlife from the ingestion of herbicides was completed using various sources of information. Syracuse Environmental Research Associates, Inc. (SERA) risk assessments authored by Dr. Patrick Durkin, (under contract to the Forest Service) formed a basis for the narratives and tables. David Bakke, USDA Forest Service Region 5 Pesticide Use Specialist, developed the worksheets, which contain these tables (found within the Project File for the Rush Skeleton Weed Project at the Beckwourth Ranger District). In addition, peer reviewed scientific studies were reviewed to assess the potential effects of herbicides on wildlife in field situations (as opposed to laboratory experiments) as well as the potential effects of noxious weeds on wildlife species and their habitats.

In essence, this pesticide risk assessment consists of an estimate of the potential doses that different types of wildlife may be exposed to from the application of herbicides under various scenarios (e.g. large bird consuming herbicide contaminated vegetation). These doses are then compared against the lowest sub-chronic or chronic "No Observable Effect Level" (NOEL) or the "No Observable Adverse Effect Level" (NOAEL) for a comparable species. The ratio of the dose ingested to the NOEL/NOAEL is called a Hazard Quotient (HQ). The lowest NOEL or NOAEL is based on data from experiments on surrogate species (e.g. rats, dogs, ducks) instead of the species of interest themselves (spotted owls, marten, etc.). By using the lowest NOEL/NOAEL regardless of the species, we aim to partially account for interspecies variability.

The information contained in the pesticide risk assessments (SERA 2004, 2007, 2011 and 2012) takes into account the variance found within the application rate or the applied concentration of an herbicide, which may change based on local conditions. In addition, some variability occurs under the various scenarios including the percentage of an animals' diet containing contaminated materials (insects, vegetation, fish, small mammals) or a spill of a chemical into water. Regardless, exposure depends on the amount of chemical hypothetically ingested or absorbed by a type of animal (e.g. predatory bird eating contaminated fish, small bird eating contaminated insects, carnivorous mammal eating prey).

Pesticide exposure risk is expressed as a central estimate bounded by lower and upper levels. Because of the need to encompass many different types of exposure as well as the need to express the uncertainties in the assessment, the risk assessments involve numerous calculations. These calculations are contained in worksheets (USDA 2014h, 2014i, 2014j, 2014k, 2014l and 2014m) in the Rush Skeleton Weed Project File at the Beckwourth Ranger District, and are based on the SERA risk assessments for the various herbicides proposed for use in the EA. The acute scenarios discussed within the BA/BE assume that 100% of the diet contains contaminated materials. For the chronic levels discussed in this analysis (on-site), the lower level consists of 10%, the central level consists of 30%, and the upper level consists of 100% of the diet in contaminated materials.

As described in the worksheets (USDA 2014h, 2014i, 2014j, 2014k, 2014l and 2014m), exposure rates are expressed in milligrams (mg) of absorbed dose per kilogram (kg) of body weight per day. For the acute exposure scenario, the estimated residue level is taken as the product of the application rate and the residue rate. For the longer-term exposure scenario, duration of 90 days is used and the dissipation on the vegetation is estimated based on the estimated or established foliar halftimes. The quantitative risk characterization is expressed as the HQ. HQs greater than 1.0 are expressed in standard decimal notation and smaller numbers are expressed in scientific notations - e.g., 7 E-7 equivalent to 7×10-7 or 0.0000007. The HQ provides a way to compare the risk of the use of use for the various herbicides, and provides the necessary information for well-informed conclusions to be made by decision makers.

There are HQs for each of the herbicides proposed for use. Additives to the formulations that might be used when herbicides are applied are not considered quantitatively in this risk assessment.

Acute exposure – A single exposure or multiple exposures occurring within a short time (24 hours or less).

Chronic exposure – Long-term exposure studies often used to determine the carcinogenic potential of chemicals. These studies are usually performed in rats, mice, or dogs and extend over the average lifetime of the species (for a rat, exposure is 2 years).

No Observable Effect Level" (NOEL) – The dose of a chemical at which no statistically or biologically significant increases in frequency or severity of adverse effects were observed between the exposed population and its appropriate control. Effects may be produced at this dose, but they are not considered to be adverse to the organism.

No Observable Adverse Effect Level" (NOAEL) – The dose of a chemical at which no treatment related effects were observed.

General Environmental Consequences – Terrestrial and Aquatic Environment

Alternative 1 – No-action Alternative

Direct and Indirect Effects (Alternative 1)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

No direct effects (disturbance or habitat changes) on TES species are expected to result from the No-action Alternative. Potential indirect effects are the loss of important terrestrial and aquatic habitats and components, such as native vegetation, etc., due to implementing the No-action Alternative which would allow the currently infested area to expand to areas outside the Wildlife Analysis Area.

Cumulative Effects

The No-action Alternative would provide long-term protection for the existing wildlife habitat, mainly the wet meadows and riparian areas present in the Rush Skeleton Weed Project.

Alternative 2 - Proposed Action

Direct and Indirect Effects (Alternative 2)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

Direct effects include immediate changes in habitat conditions and disturbance/ harassment to individuals, including direct mortality, during project activities. Direct disturbance, including mortality to individual animals addressed in this report is highly unlikely, due to survey efforts for selected species, mitigation measures and implementation of PNF standards and guidelines. Indirect effects include effects that occur later in time or beyond the treatment area of the project. Indirect effects also can include effects to a species prey base.

Exposure of an animal to an herbicide can be either primary exposure or secondary exposure. Primary exposure results when an individual consumes food or water that contains herbicide residues. Secondary exposure results when a predator or scavenger consumes an animal that contains herbicide residues. Herbicides that accumulate in animal tissue can cause secondary exposure. The biology and behavior of a species may also dictate the level of exposure to a particular herbicide, and the level of these effects depends on the duration and extent of use of herbicides in a project area.

Laboratory experimentation indicates herbicide ingestion may adversely affect wildlife health via lethargy, weight loss, nausea, fluid loss and a reduced ability to locate and/or capture food, avoid or fight off predators and competitors, or reproduce, all potentially contributing to mortality. However, laboratory experiments are unable to account for wildlife behavior, including avoidance and selection.

Cumulative Effects

The existing condition reflects the landscape changes from all activities that have occurred in the past. The analysis of cumulative effects of the proposed action evaluates the impact on TES habitat from the existing condition within the Wildlife Analysis Area.

Present or Reasonably Foreseeable Future Activities

Present and future projects planned that overlap with the Wildlife Analysis Area may have cumulative impacts to wildlife, fisheries and amphibians.

The Discovery Mine project, which is approximately 2 acres, is in the Wildlife Analysis Area. This mining project proposes to explore sub-surface using a backhoe to dig up to 20 test trenches that would be advanced to bedrock, which is estimated to be between 5 and 15 feet deep. Trenches would be located in areas with limited or no vegetation. All test trenches would be at least 25 feet away from the active bed, bank and channel of Eureka Creek. Trenches would be ramped for safety purposes and safety fencing would be erected around the perimeter of any trench left open overnight. Trenches would be approximately 2 – 4 feet wide x up to 20 feet long x 5 – 15 feet deep, depending upon the depth of bedrock. Water would be pumped from Eureka Creek to a plastic lined, clean water holding pond (10’ x 10’ x 10’) then pumped from there to the processing equipment. All processing would be done at least 25 feet away from the creek. Waste water would be discharged into a settling pit that is about 20’ x 10’ x 10’. This project has the potential to directly harm wildlife species via equipment used, disturb potentially suitable habitat by digging it up or via noise disturbance and could potentially increase sediment in Eureka Creek. This project would have an effect on the terrestrial and aquatic species in the area and their respective habitats.

The fuelwood gathering and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. These programs allow the public to purchase a permit to remove firewood and Christmas trees (sapling tree 1 - 6” dbh) from National Forest System lands. In 2012, approximately 148 commercial woodcutting permits were issued for the Beckwourth Ranger District allowing the removal of 1,133 cords of wood. An additional 885 personal woodcutting permits allowing the removal of 2,764 cords of wood were issued. Approximately 4,425 Christmas tree permits were sold on the Beckwourth Ranger District in 2012. Commercial woodcutting, personal woodcutting and Christmas tree cutting have occurred within the Wildlife Analysis Area but amounts are not quantifiable. The Wildlife Analysis Area is open to woodcutting and Christmas tree cutting across all 10,768 acres however, Christmas tree cutting is highly unlikely do to the lack of desired tree species for Christmas trees in the area. Snags and down logs would continue to be removed by woodcutters from the Wildlife Analysis Area no matter which alternative is chosen for the Rush Skeleton Weed Project, resulting in the cumulative loss of these habitat components across the landscape.

Most of the recreation use within the Wildlife Analysis Area consists of dispersed camping, fishing, hiking, horseback riding, hunting, mining, mountain biking, off highway vehicles (OHV) use, pleasure driving, and wildlife watching. The use is expected to continue at the current rate. These activities would have a minimal effect on the terrestrial and aquatic species in the area.

Affected Environment/Environmental Consequences for Sensitive Species

Environmental Consequences – Western Bumble Bee

Alternative 1 – No-action Alternative

Direct and Indirect Effects (Alternative 1)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

There would be no direct effects on western bumble bees, as no activities would occur that would cause disturbance to individual western bumble bee. Potential indirect effects of the No-action Alternative include the loss of important habitat and components, such as native vegetation, etc., due to implementing the No-action Alternative which would allow the currently infested area to expand to areas outside the Wildlife Analysis Area. This would result in decreased foraging habitat.

Cumulative Effects

The No-action Alternative would not contribute to cumulative effects, since there are no direct or indirect effects to the Western bumble bee or its habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects (Alternative 2)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

The potential for direct effects to the bumble bee is negligible for each of the project herbicides. This is because flowering forbs and other pollinating species will be avoided during treatments. The potential for direct toxicological effects to the bumble bee is also negligible for each of the project herbicides. Depending on the herbicide, this is based on one of two acute exposure scenarios; the direct contact honeybee scenario or an herbivorous insect consuming contaminated short grass vegetation (Table 34). These exposure scenarios produced HQ values that were below the Level of Concern (LOC) which indicates the toxicological risk posed by the use of the proposed herbicides is negligible. No chronic scenarios were evaluated for terrestrial invertebrates as the opportunity for chronic exposure is also extremely low given the negligible risk of acute exposure and avoidance of flowering forbs during the proposed treatments.

Table 34. Hazard Quotients (Acute) for the Western Bumblebee

Chemical Name	Application Rates (a.e.)	Exposure Scenario	Exposure Estimate	Toxicity Value	Hazard Quotient	Exceeds Level of Concern?
Aminocyclopyrachlor	0.12 lbs/acre	Herbivorous insect, short grass	13.3 mg/kg	460 mg/kg	0.03	N
Aminocyclopyrachlor	0.19lbs/acre	Herbivorous insect, short grass	21 mg/kg	460 mg/kg	0.05	N
Chlorsulfuron*	0.08 lbs/acre	-	-	-	-	N
Chlorsulfuron*	0.147 lbs/acre	-	-	-	-	N
Aminopyralid*	0.075 lbs/acre	-	-	-	-	N
Triclopyr	1 lb/acre	Herbivorous insect, short grass	110.5 mg/kg	620 mg/kg	0.2	N

*No test data is currently available on the exposure scenario, Herbivorous insects in short grass, for Chlorsulfuron and Aminopyralid although the risk assessments (Sera 2004, 2007) for these 2 chemicals suggest the results would be similar to the other chemicals who's test figures are displayed above.

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the proposed action evaluates the impact on TES habitat from the existing condition within the Wildlife Analysis Area.

No populations of the western bumble bee are known to occur in the Wildlife Analysis Area. Cumulative effects on the western bumble bee could occur with the incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in urbanization, increases in recreational use of National Forest System lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species.

The Discovery Mine project would have a minimal effect on western bumble bees due to precautions taken to protect the suitable habitat present in the project area.

The fuelwood gathering and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of these actions has and would be to shift forest successional stages to somewhat earlier stages, while generally retaining continuous forest cover which would have no effect on the western bumble bees.

Most of the recreation use within the Wildlife Analysis Area consists of dispersed camping, fishing, hiking, horseback riding, hunting, mining, mountain biking, off highway vehicles (OHV) use, pleasure driving, and wildlife watching. The use is expected to continue at the current rate. These activities would have a minimal effect on the western bumble bees.

Determination –Western Bumble Bee

No Action

It is my determination that not implementing the Rush Skeleton Weed Project will not affect the western bumble bee.

Proposed Action

It is my determination that implementing the Rush Skeleton Weed Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the western bumble bee. This determination is based on the following:

1. There is suitable foraging and nesting habitat,
2. There are no known western bumble bee populations within the Wildlife Analysis Area,
3. Implementation of BMPs, monitoring and compliance with the RCOs.

Sierra Nevada Yellow-Legged Frog (Rana sierra)

Affected Environment – Sierra Nevada Yellow-Legged Frog

Population Status

The Sierra Nevada yellow-legged frog (SNYLF) was once the most common amphibian in high elevation aquatic ecosystems of the Sierra Nevada (Bradford et. al. 1993). This species is endemic to California and a small area of western Nevada and occurs in two distinct regions – the Sierra Nevada and several mountain ranges of coastal southern California. Sierra Nevada yellow-legged frogs range widely throughout the Sierra Nevada from northern Plumas to southern Tulare counties and they were abundant at many sites into the early 1960s. Large groups of populations in the northern Sierra Nevada and local populations elsewhere have since become extinct and have disappeared from 70-90% of its historic range in the bioregion (USDI 2003a).

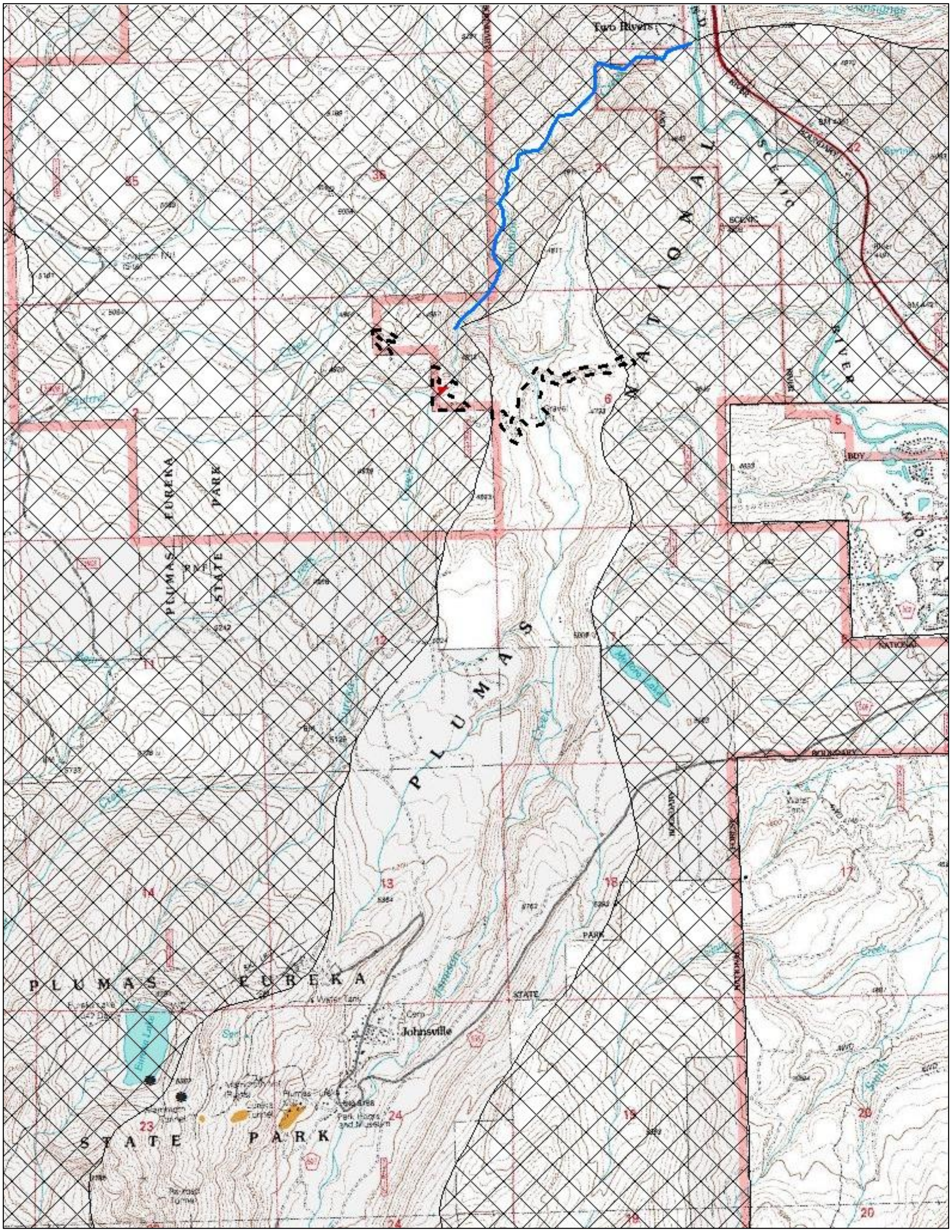
On April 25, 2013, the U.S. Fish and Wildlife Service (FWS) issued a proposed rule to list 3 amphibian species in the Sierra Nevada under the Endangered Species Act (USDI 2013a): Sierra Nevada Mountain Yellow legged frog (SYLF) (Endangered); Mountain yellow legged frog, Northern Distinct Population Segment (DPS) (Endangered); and Yosemite toad (Threatened). Of these, the Sierra Nevada Yellow-legged frog (recently classified as a separate species from the Mountain Yellow-legged Frog) is the only species that occurs on the Plumas NF. As required under the Endangered Species Act (and re-emphasized by court order), FWS also proposed Critical Habitat for each species (USDI 2013b). The April 25, 2013 proposals started a year-long review period. On April 29, 2014, the US Fish and Wildlife Service published a final rule in the Federal Register to list the Yosemite toad as threatened, and the Sierra Nevada mountain yellow-legged frogs and N DPS mountain yellow-legged frogs as endangered with extinction (USDI 2014). Critical Habitat (CH) was proposed by the USFWS (USDI 2013b), but they have delayed making a final determination on CH designation.

The closest critical habitat is in the Lakes Basin area (the Gold Lake subunit), approximately 4 miles south of the Wildlife Analysis Area.

Habitat Requirements

The Sierra Nevada yellow-legged frog (SNYLF) historically inhabited ponds, tarns, lakes and streams from 4,500 to over 12,000 ft. elevation (Stebbins 1985 in USDA 2001). Adults are highly aquatic and are typically associated with near-shore areas of lakes for reproduction, cover, foraging, and over-wintering and in low gradient (up to 4%) perennial streams with irregular shores and rocks (USDA 2001). Streams in this category generally have the potential for deep pools (12-20”) and undercut banks that provide suitable breeding and overwintering habitat. They prefer well illuminated, sloping banks of meadow streams, riverbanks, isolated pools with vegetation that are continuous to the water’s edge (Martin et al. 1994, Zeiner et al. 1988). This species is seldom far from water. On the PNF, this species is found in the Bucks Lake Wilderness, the Lakes Basin, near the confluence of the Middle Fork of the Feather River and Nelson Creek, as well as in several streams throughout the Forest. The closet known SNYLF observations were in 1978 and 1994, are approximately 5 stream miles away from the Wildlife Analysis Area. No SNYLF have been detected within the Wildlife Analysis Area (Figure 7).

Figure 7. Critical Aquatic Refuge (cross hatched line), Wildlife Analysis Area (dashed line) Currently Infested Area



(solid color (red)), Historic locations (dots) and unidentified adult frogs (*rana* species) (solid line (blue)).

In a telemetry study by Matthews and Pope (1999), Sierra Nevada yellow-legged frog overland movements were restricted to the month of September and were thought to have been associated with seasonal migrations between summer and over-wintering sites. Frogs were found in exposed rocky habitats significantly more during this migration period. Frogs moved from their original capture lake an average distance of 145m (476 feet). These movements were often associated with stream corridors however overland movements in dry rocky terrain were observed for up to 66m (217 feet). Overland movements did not appear to be influenced by cover types. Movements were clearly destination driven and occurred in short bursts with one individual completing this 66m journey in only 44 minutes. This new information suggests that the use of upland habitat by the Sierra Nevada yellow-legged frog is very limited in both space and time.

It is unknown if or to what extent overland movements occur with stream dwelling SNYLFs. A three-year SNYLF telemetry study tracked fifty frogs (forty-seven female and three male) affixed with radio transmitters from July 2005 through September 2007 in Bean Creek and Spanish Creek, both on the Mt. Hough Ranger District of the PNF (MGW Biological and Klamath Wildlife Resources 2008). The objective of the study was to determine the dispersal behavior of the SNYLF in relation to streams and adjacent terrestrial habitat.

Findings from the SNYLF study show that the frogs are extremely territorial and found at or near the same pool after each visit. Findings also show that female SNYLFs move downstream towards male frogs when temperatures drop. SNYLFs occupying streams within the study areas on the PNF do not seem to travel overland, but move within the confines of the aquatic environment.

While direct habitat degradation has not been cited as a cause of declines of this species, key management activities that the Forest Service can influence include: exotic fish stocking, pack stock use and access, recreation, and locally applied chemical toxins (pesticides and herbicides) (USDA 2001). The proposed action for the Rush Skeleton Weed project includes herbicide use.

Wildlife Analysis Area Surveys

In 2004, the eastern portion of the Wildlife Analysis Area was surveyed to protocol standards as part of the Happy Jack Project (from the confluence with Eureka Creek continuing upstream along Jamison Creek to just north of Madora Lake, (Fellers and Freel 1995)). This survey covered approximately 65 percent of the Wildlife Analysis Area. No Sierra Nevada yellow-legged frogs were detected in the Wildlife Analysis Area, however 2 unidentified adult frogs (*Rana* species) were observed (0.25 to 2 miles) downstream of the Wildlife Analysis Area.

Surveys of all utilization unknown habitat (suitable habitat with unknown occupancy) would be conducted prior to implementation of the project. If SNYLF’s are found a 100 foot buffer from the water’s edge out would be applied where only the select (direct dabbing or similar) method of herbicide treatment would occur. Manual treatments would still be implemented between 10 feet and the water’s edge.

Environmental Consequences – Sierra Nevada Yellow-Legged Frogs

Alternative 1 – No-action Alternative

Direct and Indirect Effects (Alternative 1)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

There would be no direct effects on SNYLFs, as no activities would occur that would cause disturbance to individual SNYLF. Potential indirect effects of the No-action Alternative include the loss of important habitat and components, such as native vegetation, etc., due to implementing the No-action Alternative which would allow the currently infested area to expand to areas outside the Wildlife Analysis Area.

Cumulative Effects

The No-action Alternative would not contribute to cumulative effects, since there are no direct or indirect effects to the SNYLF or its habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects (Alternative 2)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

Sierra Nevada yellow-legged frogs may be affected by implementation of the proposed action in the following ways:

1. Direct contact with herbicides,
2. Indirect contact through prey and sprayed vegetation,
3. Chemical spills or overspray,
4. Disturbance from people walking through habitat.

Direct effects to the SNYLFs would be primarily associated with herbicide application near streams and associated riparian areas, lakes, or wetlands. In some cases soil may be a major receptor and contamination can occur by chemicals leaching through the soil to the groundwater and ultimately reaching the aquatic environment. This method of introduction usually poses the least amount of risk to the aquatic environment because chemicals typically disappear from the ground surface by either plant uptake of the chemical, volatilization, and natural decomposition of the active ingredients or adsorption of the herbicide by soil particles. Leaks, spills, and improper storage and handling of containers are the source of most pesticide related groundwater contamination. These impacts can easily be mitigated with proper training of personnel and proper storage and disposal of chemicals. Risk from an accidental spill of herbicide into a water body on the Forest is considered very low.

Another mode of pesticide entry to the aquatic system includes overland flow from precipitation events. Risk varies depending on soil composition and timing and intensity of precipitation events after application. Risk tends to be lower on well-vegetated forests and rangeland where soil infiltration is typically greater than precipitation. Overland flow occurs infrequently on most forest land because the infiltration capacity of the forest floor and soil is usually far greater than the rate of precipitation. Aquatic organisms are more at risk of negative impacts from herbicides in small perennial streams, or during late season when flow is reduced, due to their limited capability for dilution. Design features and other prevention measures (mitigations) (BA/BE pages 48-49) proposed to address this issue are included in Chapter 2.

The potential for direct toxicological effects to SNYLFs is negligible for each of the project herbicides. This is based on acute and chronic exposure scenarios where test fish or amphibians are exposed to peak expected environmental concentrations (EEC) of each herbicide (Table 35 and Table 36). These exposure scenarios produced HQ values that were below the LOC for all the project herbicides. Peak EEC values were used rather than concentration estimates based on accidental spills because the spill scenario involves a 30-gal spill. At no time will 30 gallons of herbicide be on-site during this project therefore spills of this magnitude are not possible. This indicates that the toxicological risk posed to the SNYLFs by the use of the proposed herbicides is negligible.

Table 35. Hazard Quotients (Acute) for SNYLFs

Chemical Name	Application Rates (a.e.)	Exposure Scenario	Exposure Estimate	Toxicity Value	Hazard Quotient	Exceeds Level of Concern?
Aminocyclopyrachlor	0.12 lbs/acre	Pond Spill, Fish (tolerant)	1.59 mg/L	120 mg/L	0.01	N
Aminocyclopyrachlor	0.19lbs/acre	Pond Spill, Fish (tolerant)	1.74 mg/L	120 mg/L	0.01	N
Chlorsulfuron	0.08 lbs/acre	Pond Spill, Fish (tolerant)	0.42 mg/L	300 mg/L	0.001	N
Chlorsulfuron	0.147 lbs/acre	Pond Spill, Fish (tolerant)	0.73 mg/L	300 mg/L	0.002	N
Aminopyralid	0.075 lbs/acre	Pond Spill, Fish (tolerant)	3.41 mg/L	100 mg/L	0.03	N
Aminopyralid	0.075 lbs/acre	Pond Spill, Amphibian (tolerant)	3.41 mg/L	95.2 mg/L	0.04	N
Triclopyr	1 lb/acre	Pond Spill, Fish (tolerant)	18.17 mg/L	210 mg/L	0.1	N
Triclopyr	1 lb/acre	Pond Spill, Amphibian (tolerant)	18.17 mg/L	125 mg/L	0.1	N

Table 36. Hazard Quotients (Chronic) for SNYLFs

Chemical Name	Application Rates (a.e.)	Exposure Scenario	Exposure Estimate	Toxicity Value	Hazard Quotient	Exceeds Level of Concern?
Aminocyclopyrachlor	0.12 lbs/acre	Concentration in Surface Water, Fish (tolerant)	0.04mg/L	11 mg/L	0.004	N
Aminocyclopyrachlor	0.19lbs/acre	Concentration in Surface Water, Fish (tolerant)	0.06 mg/L	11 mg/L	0.006	N
Chlorsulfuron	0.08 lbs/acre	Concentration in Surface Water, Fish (tolerant)	0.00004 mg/L	32 mg/L	0.000001	N
Chlorsulfuron	0.147 lbs/acre	Concentration in Surface Water, Fish (tolerant)	0.00007 mg/L	32 mg/L	0.000002	N
Aminopyralid	0.075 lbs/acre	Concentration in Surface Water, Fish (tolerant)	0.02 mg/L	1.36 mg/L	0.01	N
Triclopyr	1 lb/acre	Concentration in Surface Water, Fish (tolerant)	0.06 mg/L	78 mg/L	0.001	N

Despite the risk, there is very low likelihood of herbicides reaching any stream due to application criteria, which takes into account the time of year, wind velocity, and period to the next rainfall; and implementation of all applicable BMPs for herbicide application. Given the acreage size of 42 acres and the low risk from the herbicides proposed for use, it is unlikely that there would be any discernible direct or indirect effects to SNYLFs by the implementation of herbicide treatments, and no significant adverse cumulative watershed effects (refer to Table 35 and Table 36 above and the Rush Skeleton Weed Project Cumulative Watershed Effects & Soils Assessment Report (USDA 2014b)).

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the proposed action evaluates the impact on TES habitat from the existing condition within the Wildlife Analysis Area.

Cumulative effects on SNYLFs could occur with the incremental loss of the quantity and/or quality of habitat for these species. Overall, increases in urbanization, increases in recreational use of National Forest System lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for these species.

The Discovery Mine project would have moderate effect on SNYLFs or their habitat. This is based on the use of equipment and digging trenches in the suitable habitat and the potential for increased turbidity and sediment load in Eureka Creek due to project activities.

The fuelwood gathering and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of these actions has and would be to shift forest successional stages to somewhat earlier stages, while generally retaining continuous forest cover which would have no effect on the SNYLFs.

Most of the recreation use within the Wildlife Analysis Area consists of dispersed camping, fishing, hiking, horseback riding, hunting, mining, mountain biking, off highway vehicles (OHV) use, pleasure driving, and wildlife watching. The use is expected to continue at the current rate. These activities may affect this species through direct disturbance, trampling or crushing by humans, pack stock and/or OHV, etc., and habitat degradation however in this area these effects are expected to be minimal on the SNYLFs. This is based on the dispersed nature of the activities in this area and the lack of concentrated recreation use areas (campgrounds, etc.).

Determination –Sierra Nevada Yellow-Legged Frogs

No Action – Sierra Nevada Yellow-Legged Frog

It is my determination that not implementing the Rush Skeleton Weed Project will not affect the Sierra Nevada yellow-legged frog or its proposed critical habitat.

Proposed Action – Sierra Nevada Yellow-Legged Frog

It is my determination that implementing the Rush Skeleton Weed project may affect but is not likely to adversely affect individuals and is not likely to destroy or adversely modify proposed critical habitat. This determination is based on the following:

1. Presence of potentially suitable habitat,
2. There are no known SNYLF populations within the Wildlife Analysis Area,
3. Closest known detection is approximately 5 stream miles away,
4. No proposed critical habitat in the Wildlife Analysis Area,
5. Implementation of BMPs, monitoring and compliance with the RCOs.

Foothill Yellow-Legged Frog (Rana boylii)

Affected Environment – Foothill Yellow-Legged Frog

Population Status

The foothill yellow-legged frog (FYLF) historically occurred from northern Baja California to southern Oregon west of the Sierra-Cascade crest. This species has experienced significant population declines especially in the southern part of its range (southern Sierra Nevada and south coastal California). In the Sierra Nevada, it apparently has disappeared from 66% of its historic range (Jennings 1995, 1996).

Habitat Requirements

The foothill yellow-legged frog (FYLF) historically occurred in foothill and mountain streams to 6,000 feet (USDA 2001). Adults use both in-stream and riparian environments, although use of riparian areas and adjacent uplands is poorly understood (Ibid). This species is found in or near rocky perennial streams and rivers in a variety of habitats, including riparian, mixed conifer and wet meadow types. It inhabits areas with moving water but tends to avoid areas with steep gradients (Zweifel 1955). These frogs prefer partial shade, shallow riffles, and cobble sized or greater substrate (Hayes and Jennings 1988). On the PNF, this species is found in a few of the larger riverine systems, such as lower portions of the South Fork, Middle Fork and North Fork Feather River (NFFR), and Spanish Creek, but has also been found in smaller tributary streams of these larger systems. The Wildlife Analysis Area is approximately 20 stream miles away from nearest FYLF observation (surveys conducted in 2000). There are no observations of FYLFs within the Wildlife Analysis Area (Figure 8).

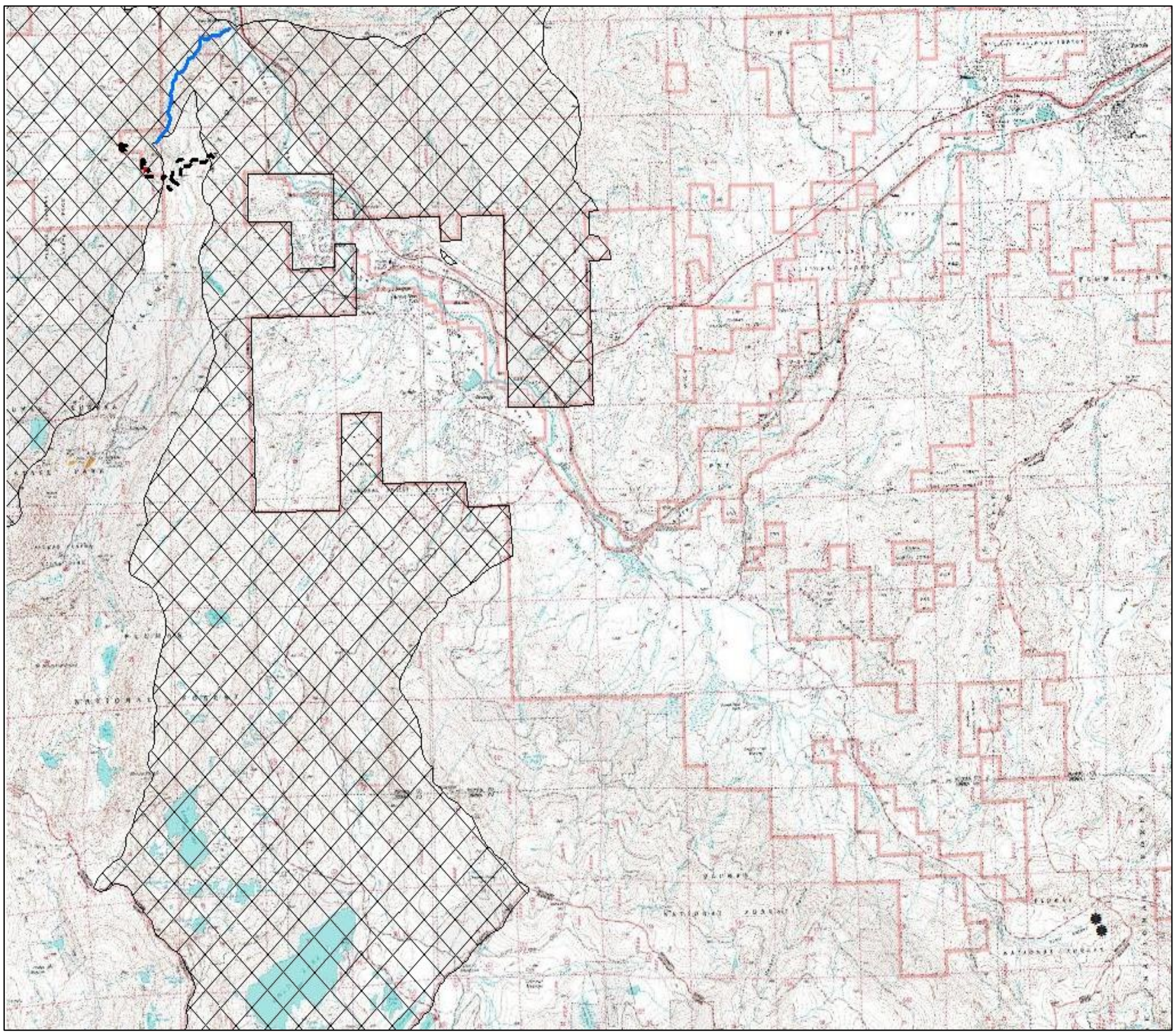


Figure 8. Critical Aquatic Refuge (cross hatched line), Wildlife Analysis Area (dashed line) Currently Infested Area (solid color (red)), Historic locations (dots) and unidentified adult frogs (*rana* species) (solid line (blue)).

Use of riparian areas and adjacent upland movements of FYLF are not well understood (USDA 2001). Habitat characteristics associated with non-breeding adult FYLFs have not been fully evaluated. Overwintering behavior is completely unknown, but adults are commonly found in tributaries prior to being found in the main stem waterway. They are rarely seen more than a few meters away from water, but it remains unknown if they utilize upland areas during winter months (Kupferberg 1996). Habitat use of juvenile frogs is also largely unknown. Some evidence indicates that they potentially use smaller waterways such as springs or small tributary streams (Lind et al. 2011).

Key management activities which the Forest Service can influence are: dams and diversions, mining, livestock grazing, recreation, vegetation management and mechanical fuel treatment, roads (road work, water drafting, etc.), and locally applied chemical toxins (pesticides and herbicides). In addition, fire can directly affect amphibians (USDA 2001). The proposed action for the Rush Skeleton Weed project includes herbicide use.

Wildlife Analysis Area Surveys

In 2004, the eastern portion of the Wildlife Analysis Area was surveyed to protocol standards as part of the Happy Jack Project (from the confluence with Eureka Creek continuing upstream along Jamison Creek to just north of Madora Lake, (Fellers and Freel 1995)). This survey covered approximately 65 percent of the Wildlife Analysis Area. No foothill yellow-legged frogs were detected in the Wildlife Analysis Area, however 2 unidentified adult frogs (*Rana* species) were observed (0.25 to 2 miles) downstream of the Wildlife Analysis Area.

Surveys of all utilization unknown habitat (suitable habitat with unknown occupancy) would be conducted prior to implementation of the project.

Environmental Consequences – Foothill Yellow-Legged Frogs

Alternative 1 – No-action Alternative

Direct and Indirect Effects (Alternative 1)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

There would be no direct effects on FYLFs, as no activities would occur that would cause disturbance to individual FYLF. Potential indirect effects of the No-action Alternative include the loss of important habitat and components, such as native vegetation, etc., due to implementing the No-action Alternative which would allow the currently infested area to expand to areas outside the Wildlife Analysis Area.

Cumulative Effects

The No-action Alternative would not contribute to cumulative effects, since there are no direct or indirect effects to the FYLF or its habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects (Alternative 2)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

Foothill yellow-legged frogs may be affected by implementation of the proposed action in the following ways:

1. Direct contact with herbicides,
2. Indirect contact through prey and sprayed vegetation,
3. Chemical spills or overspray,
4. Disturbance from people walking through habitat.

Direct effects to the FYLFs would be primarily associated with herbicide application near streams and associated riparian areas, lakes, or wetlands. In some cases soil may be a major receptor and contamination can occur by chemicals leaching through the soil to the groundwater and ultimately reaching the aquatic environment. This method of introduction usually poses the least amount of risk to the aquatic environment because chemicals typically disappear from the ground surface by either plant uptake of the chemical, volatilization, and natural decomposition of the active ingredients or adsorption of the herbicide by soil particles. Leaks, spills, and improper storage and handling of containers are the source of most pesticide related groundwater contamination. These impacts can easily be mitigated with proper training of personnel and proper storage and disposal of chemicals. Risk from an accidental spill of herbicide into a water body on the Forest is considered very low.

Another mode of pesticide entry to the aquatic system includes overland flow from precipitation events. Risk varies depending on soil composition and timing and intensity of precipitation events after application. Risk tends to be lower on well-vegetated forests and rangeland where soil infiltration is typically greater than precipitation. Overland flow occurs infrequently on most forest land because the infiltration capacity of the forest floor and soil is usually far greater than the rate of precipitation. Aquatic organisms are more at risk of negative impacts from herbicides in small perennial streams, or during late season when flow is reduced, due to their limited capability for dilution. Design features and other prevention measures (mitigations) (USDA 2014c, pages 48-49) proposed to address this issue are included in Chapter 2.

The potential for direct toxicological effects to FYLFs is negligible for each of the project herbicides. This is based on acute and chronic exposure scenarios where test fish or amphibians are exposed to peak expected environmental concentrations (EEC) of each herbicide (Table 35 and Table 36 under the SNYLF section above). These exposure scenarios produced HQ values that were below the LOC for all the project herbicides. Peak EEC values were used rather than concentration estimates based on accidental spills because the spill scenario involves a 30-gal spill. At no time will 30 gallons of herbicide be on-site during this project therefore spills of this magnitude are not possible. This indicates that the toxicological risk posed to the FYLFs by the use of the proposed herbicides is negligible.

Despite the risk, there is very low likelihood of herbicides reaching any stream due to application criteria, which takes into account the time of year, wind velocity, and period to the next rainfall; and implementation of all applicable BMPs for herbicide application. Given the acreage size of 42 acres and the low risk from the herbicides proposed for use, it is unlikely that there would be any discernible direct or indirect effects to FYLFs by the implementation of herbicide treatments, and no significant adverse cumulative watershed effects (refer to Table 35 and Table 36 under the SNYLF section above and the Rush Skeleton Weed Project Cumulative Watershed Effects & Soils Assessment Report (USDA 2014b)).

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the proposed action evaluates the impact on TES habitat from the existing condition within the Wildlife Analysis Area.

Cumulative effects on FYLFs could occur with the incremental loss of the quantity and/or quality of habitat for these species. Overall, increases in urbanization, increases in recreational use of National Forest System lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for these species.

The Discovery Mine project would have moderate effect on FYLFs or their habitat. This is based on the use of equipment and digging trenches in the suitable habitat and the potential for increased turbidity and sediment load in Eureka Creek due to project activities.

The fuelwood gathering and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of these actions has and would be to shift forest successional stages to somewhat earlier stages, while generally retaining continuous forest cover which would have no effect on the FYLFs.

Most of the recreation use within the Wildlife Analysis Area consists of dispersed camping, fishing, hiking, horseback riding, hunting, mining, mountain biking, off highway vehicles (OHV) use, pleasure driving, and wildlife watching. The use is expected to continue at the current rate. These activities may affect this species through direct disturbance, trampling or crushing by humans, pack stock and/or OHV, etc., and habitat degradation however in this area these effects are expected to be minimal on the FYLFs. This is based on the dispersed nature of the activities in this area and the lack of concentrated recreation use areas (campgrounds, etc.).

Determination – Foothill Yellow-Legged Frogs

No Action – Foothill Yellow-Legged Frog

It is my determination that not implementing the Rush Skeleton Weed Project will not affect the foothill yellow-legged frogs.

Proposed Action – Foothill Yellow-Legged Frog

It is my determination that implementing the Rush Skeleton Weed project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the foothill yellow-legged frog. This determination is based on the following:

1. Presence of potentially suitable habitat,
2. There are no known FYLF populations within the Wildlife Analysis Area,
3. Closest known detection is approximately 20 stream miles away,
4. Implementation of BMPs, monitoring and compliance with the RCOs.

Fringed Myotis (Myotis thysanodes), Pallid Bat (Antrozous pallidus)and Townsend’s Big-eared Bat (Corynorhinus townsendii)

Environmental Consequences – Bats

Alternative 1 – No-action Alternative

Direct and Indirect Effects (Alternative 1)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

There would be no direct effects on bats, as no activities would occur that would cause disturbance to individual bats. Potential indirect effects of the No-action Alternative include the loss of important habitat and components, such as native vegetation, etc., due to implementing the No-action Alternative which would allow the currently infested area to expand to areas outside the Wildlife Analysis Area. This would result in decreased foraging habitat.

Cumulative Effects

The No-action Alternative would not contribute to cumulative effects, since there are no direct or indirect effects to the bat species or its habitat.

Alternative 2 – Proposed Action

The implementation of Management Area direction and maintaining aquatic/riparian ecosystem processes would provide many of the habitat attributes necessary to support the sensitive bat species. Potentially suitable habitat exists within the Wildlife Analysis Area for all three of these bat species (fringed myotis, pallid bat and Townsend’s big-eared bat).

Direct and Indirect Effects (Alternative 2)

Indicator Measure 1: Probability of consuming herbicide contaminated prey and disturbance during application.

Bats may be affected by implementation of the proposed action in the following ways:

1. Direct contact with herbicides,
2. Indirect contact through prey and sprayed vegetation,
3. Effects to vegetation type (e.g. maintenance of early seral stage),
4. Chemical spills or overspray,

The potential for direct toxicological effects to bats is negligible for each of the proposed herbicides. This is based on the acute and chronic scenarios involving several exposure routes including direct exposure and the ingestion of contaminated water and prey (Table 37 and Table 38). These exposure scenarios produced HQ values that were below the LOC which indicates the toxicological risk posed by the use of the proposed herbicides is negligible. With respect to indirect effects, the effects to prey habits should be minor because these bats utilize a wide variety of habitats for foraging, so they are not tied to one given area or vegetation type. Given the acreage size of 42 acres and the low risk from the herbicides proposed for use, there would be no discernable direct or indirect effects expected to bats by the implementation of herbicide treatments.

Table 37. Hazard Quotients (Acute) for Bats

Chemical Name	Application Rates (a.e.)	Exposure Scenario	Exposure Estimate	Toxicity Value	Hazard Quotient	Exceeds Level of Concern?
Aminocyclopyrachlor	0.12 lbs/acre	Small mammal, contaminated insects	11.79 mg/kg	350 mg/kg	0.03	N
Aminocyclopyrachlor	0.12 lbs/acre	Contaminated water	0.01 mg/kg	350 mg/kg	0.00004	N
Aminocyclopyrachlor	0.12 lbs/acre	Direct exposure 100% absorption	5.82 mg/kg	350 mg/kg	0.02	N
Aminocyclopyrachlor	0.19lbs/acre	Small mammal, contaminated insects	18.67 mg/kg	350 mg/kg	0.05	N
Aminocyclopyrachlor	0.19lbs/acre	Contaminated water	0.02 mg/kg	350 mg/kg	0.00006	N
Aminocyclopyrachlor	0.19lbs/acre	Direct exposure 100% absorption	9.21 mg/kg	350 mg/kg	0.03	N
Chlorsulfuron	0.08 lbs/acre	Small mammal, contaminated insects	4.62 mg/kg	75 mg/kg	0.06	N
Chlorsulfuron	0.08 lbs/acre	Contaminated water	0.001 mg/kg	75 mg/kg	0.00002	N
Chlorsulfuron	0.08 lbs/acre	Direct exposure 100% absorption	2.28 mg/kg	75 mg/kg	0.03	N

Chemical Name	Application Rates (a.e.)	Exposure Scenario	Exposure Estimate	Toxicity Value	Hazard Quotient	Exceeds Level of Concern?
Chlorsulfuron	0.147 lbs/acre	Small mammal, contaminated insects	7.86 mg/kg	75 mg/kg	0.1	N
Chlorsulfuron	0.147 lbs/acre	Contaminated water	0.002 mg/kg	75 mg/kg	0.00003	N
Chlorsulfuron	0.147 lbs/acre	Direct exposure 100% absorption	3.88 mg/kg	75 mg/kg	0.05	N
Aminopyralid	0.075 lbs/acre	Small mammal, contaminated insects	7.37 mg/kg	104 mg/kg	0.07	N
Aminopyralid	0.075 lbs/acre	Contaminated water	0.007 mg/kg	104 mg/kg	0.0001	N
Aminopyralid	0.075 lbs/acre	Direct exposure 100% absorption	3.64 mg/kg	104 mg/kg	0.04	N
Triclopyr	1 lb/acre	Small mammal, contaminated insects	98.25 mg/kg	440 mg/kg	0.2	N
Triclopyr	1 lb/acre	Contaminated water	0.04 mg/kg	440 mg/kg	0.0001	N
Triclopyr	1 lb/acre	Direct exposure 100% absorption	48.49 mg/kg	440 mg/kg	0.1	N

Table 38. Hazard Quotients (Chronic) for Bats

Chemical Name	Application Rates (a.e.)	Exposure Scenario	Exposure Estimate	Toxicity Value	Hazard Quotient	Exceeds Level of Concern?
Aminocyclopyrachlor	0.12 lbs/acre	Contaminated water	0.01mg/kg	350 mg/kg	0.00002	N
Aminocyclopyrachlor	0.19lbs/acre	Contaminated water	0.01 mg/kg	350 mg/kg	0.00003	N
Chlorsulfuron	0.08 lbs/acre	Contaminated water	0.00001 mg/kg	5 mg/kg	0.000001	N
Chlorsulfuron	0.147 lbs/acre	Contaminated water	0.00001 mg/kg	5 mg/kg	0.000002	N
Aminopyralid	0.075 lbs/acre	Contaminated water	0.003 mg/kg	50 mg/kg	0.0001	N
Triclopyr	1 lb/acre	Contaminated water	0.01 mg/kg	22 mg/kg	0.0004	N

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the proposed action evaluates the impact on TES wildlife from the existing condition within the Wildlife Analysis Area.

No populations of sensitive bat species are known to occur in the Wildlife Analysis Area, their presence is assumed. Cumulative effects on bats could occur with the incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in urbanization, increases in recreational use of National Forest System lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species.

The Discovery Mine project would have a minimal effect on bats and their habitat due to the lack of suitable disturbance since activities would take place on areas with little to no vegetation.

The fuelwood gathering and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of these actions has and would be to shift forest successional stages to somewhat earlier stages, while generally retaining continuous forest cover could cause disturbance that could disrupt and preclude successful recruitment of young as well as remove roost trees (maternity roosts, etc.), especially during the breeding season through the removal of desired habitat components such as snags, live trees, etc.

Most of the recreation use within the Wildlife Analysis Area consists of dispersed camping, fishing, hiking, horseback riding, hunting, mining, mountain biking, off highway vehicles (OHV) use, pleasure driving, and wildlife watching. The use is expected to continue at the current rate. These activities would have a minimal effect on the bats in the area.

Determination –Bats

No Action

It is my determination that not implementing the Rush Skeleton Weed Project will not affect the (fringed myotis, pallid bat and Townsend’s big-eared bat).

Proposed Action

It is my determination that implementing the Rush Skeleton Weed Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the bats (fringed myotis, pallid bat and Townsend’s big-eared bat). This determination is based on the following:

1. No known populations of bats (fringed myotis, pallid bat and Townsend’s big-eared bat) in the Wildlife Analysis Area, but presence is assumed;
2. There is suitable roosting and foraging habitat in the Wildlife Analysis Area;
3. Implementation of BMPs, monitoring and compliance with the RCOs.

Summary of Determinations

Alternative 2 - Proposed Action

The proposed action would protect and maintain key sensitive species habitat areas through project design, and riparian areas and meadows would be managed by designating RCAs and meeting BMPs during implementation. Nevertheless, impacts to National Forest System lands resulting from the Rush Skeleton Weed Project are expected to contribute to cumulative impacts on certain sensitive wildlife species. See Table 39 for a summary of the determinations.

These project level effects determinations are consistent with the determinations reached in the SNFPA 2004 ROD by meeting the following three conditions:

1. The project is designed in accordance with all Forest Plan design criteria as analyzed in the SNFPA FSEIS 2004 ROD, Table 2;
2. The spatial location and timing of this project, when considered cumulatively with all other projects affecting TES species and TES habitat, have been analyzed and results in a determination consistent with that reached in the SNFPA FSEIS 2004 ROD;
3. Available new information that was not available in the SNFPA FSEIS 2004 ROD has been included in this project level analysis and this new information leads to the same conclusion as that within the SNFPA FSEIS 2004 ROD.

Table 39. Determinations of Effects on Threatened, Endangered, Proposed, and Sensitive Animal Species that Potentially Occur on the Plumas National Forest

Species	Alternative 1 (No Action)*	Alternative 2 (Proposed Action)*
INVERTEBRATES		
Western bumble bee (*bombus occidentalis*)	WNA	MAI
AMPHIBIANS		
Foothill yellow-legged frog (*Rana boylii*)	WNA	MAI
Sierra Nevada yellow-legged frog (*Rana sierrae*)	WNA	MAINLA / NLRDAM
MAMMALS		
Fringed myotis (*Myotis thysanodes*)	WNA	MAI
Pallid bat (*Antrozous pallidus*)	WNA	MAI
Townsend's big-eared bat (*Corynorhinus townsendii*)	WNA	MAI

*__Determinations:__ **T & E Species: WNA** = Will Not Affect, **MAINLA** = May Affect but Is Not Likely to Adversely Affect Individuals or their designated critical habitat, **MAILAA** = May Affect and Is Likely to Adversely Affect Individuals or their designated critical habitat.
Proposed (P) Species: WNA = Will Not Affect, **MAINLJCE =** May Affect but is Not Likely to Jeopardize the Continued Existence of Individuals, **MAILJCE** = May Affect but is Likely to Jeopardize the Continued Existence of Individuals
Proposed Critical Habitat: WNA = Will Not Affect, **NLRDAM** = Not Likely to Result in the Destruction or Adverse Modification of their Proposed Critical Habitat, **LRDAM** = Likely to Result in the Destruction or Adverse Modification of their Proposed Critical Habitat,
FS Sensitive Species: WNA = Will Not Affect, **MAI** = May Affect Individuals, but is not likely to result in a trend toward Federal listing or loss of viability, **MAILRTFL** = May Affect Individuals, and is Likely to Result in a Trend toward Federal Listing or loss of viability.

Specific Design Features or Mitigations

- Sierra Nevada Yellow-legged Frog:
    - Pre-treatment surveys would be conducted by a qualified biologist:

- If SNYLF's are found a 100 foot buffer from the water's edge out would be applied where only the select (direct dabbing or similar) method of herbicide treatment would occur. Manual treatments would still be implemented between 10 feet and the water's edge.
- If no SNYLF's are found all treatment would be implemented as proposed and analyzed in this document.

Botanical Resources

The project area was reviewed using aerial photographs, soils maps and known rare plant occurrence data to determine potential habitat for rare plant species. The project area was surveyed for sensitive species by PNF botanists in spring and summer of 2013 in support of the Discovery Project. The rush skeleton weed infestation was found during those surveys. In spring of 2014 the discontinuous project areas to the east and west of the Discovery Project were surveyed. No sensitive plant species were found in the project area. Two wetland special habitats were found in the project area. One spring emerges from the ground approximately 150 feet east of and flows into Eureka Creek within the project area. Another spring was found along Jamison Creek at the site of a rock quarry. These two wetland habitats were surveyed for sensitive plants and none were found.

No sensitive plants were found in the project area. Consequently, a biological evaluation of impacts to sensitive plant species is not required. The following several pages provide direction regarding sensitive plant management and the methodology used to reach this conclusion.

The purpose of a Biological Evaluation (BE) is to provide an analysis of the Proposed Action in the Rush Skeleton Weed Project Environmental Assessment and to determine whether it would result in a trend toward a Sensitive plant species becoming Federally listed as Threatened or Endangered under the Endangered Species Act (1973, as amended).

Affected Environment/Environmental Consequences

Affected Environment

The Rush Skeleton Weed Project area includes mixed conifer forest, riparian area along Eureka Creek, a spring and a dispersed campsite. The elevation ranges from 4,500 along Eureka Creek to 4,800 feet at the western edge of the project are.

The plant communities within the project area is primarily Sierra mixed conifer forest. The springs and riparian areas are dominated by willows and wetland herbs.

Rare Species

Table 40 lists all Federally Threatened, Candidate and Region 5 Sensitive vascular plant, moss, lichen and fungi species that are known or thought to have potential to occur within the Rush Skeleton Weed Project area boundary. Also included in the table is the listing, whether potential habitat exists within the project area, whether the species is known to occur in the project area and whether the species is analyzed in the document.

Table 40 Species known or having potential to occur within the Rush Skeleton Weed Project area

SPECIES	PNF Status[1]	Species within Project Area?	Potential Habitat within Project Area?	Species analyzed?
Allium jepsonii	S	N	N	No, no serpentine outcrops in the project area.
Arabis constancei	S	N	N	No, no serpentine outcrops in the project area.
Astragalus lemmonii	S	N	Y	No, potential habitat searched and species not found.
Astragalus lentiformis	S	N	Y	No, potential habitat searched and species not found.
Astragalus pulsiferae var. coronensis	S	N	Y	No, potential habitat searched and species not found.
Astragalus pulsiferae var. pulsiferae	S	N	N	No. Proposed project is o ut of geographic range.
Astragalus webberi	S	N	N	No. Proposed project is o ut of geographic range.
Balsamorhiza macrolepis var. macrolepis	S	N	N	No, no serpentine soils or foothill woodlands habitat in project area.
Botrychium ascendens	S	N	Y	No, potential habitat searched and species not found.
Botrychium crenulatum	S	N	Y	No, potential habitat searched and species not found.
Botrychium lunaria	S	N	Y	No, potential habitat searched and species not found.
Botrychium minganense	S	N	Y	No, potential habitat searched and species not found.
Botrychium montanum	S	N	Y	No, potential habitat searched and species not found.
Botrychium pinnatum	S	N	Y	No, potential habitat searched and species not found.
Bruchia bolanderi	S	N	Y	No, potential habitat searched and species not found.
Buxbaumia viridis	S	N	N	No. No decay class 3, 4 or 5 down logs found during stream surveys,
Calycadenia oppositifolia	S	N	N	No, proposed project is too high in elevation.
Clarkia gracilis ssp. albicaulis	S	N	N	No, proposed project is too high in elevation.
Clarkia mildrediae ssp. mildrediae	S	N	N	No. Proposed project is o ut of geographic range.
Clarkia mosquinii	S	N	N	No. Proposed project is o ut of geographic range.
Cypripedium fasciculatum	S	N	N	No, potential habitat searched and species not found.
Cypripedium montanum	S	N	N	No, potential habitat searched and species not found.
Dendrocollybia racemosa	S	N	N	No. Habitat model shows no medium or high quality habitat in project area.
Eleocharis torticulmis	S	N	N	No, proposed project is too high in

SPECIES	PNF Status[1]	Species within Project Area?	Potential Habitat within Project Area?	Species analyzed?
				elevation.
Eriogonum microthecum var. schoolcraftii	S	N	N	No. No eastside pine or pinyon-juniper habitat in project area.
Eriogonum umbellatum var. ahartii	S	N	N	No, no serpentine outcrops in the project area.
Fissidens aphelotaxifolius	S	N	Y	No, potential habitat searched and species not found.
Fissidens pauperculus	S	N	N	No, proposed project is too high in elevation and proposed project is outside geographic range.
Fritillaria eastwoodiae	S	N	N	No, proposed project is outside geographic range.
Helodium blandowii	S	N	Y	No, potential habitat searched and species not found.
Hydrothyria venosa	S	N	Y	No, potential habitat searched and species not found.
Ivesia aperta var. aperta	S	N	N	No. No vernally moist meadows or alkali flats in project area.
Ivesia sericoleuca	S	N	N	No. No vernally moist meadows or alkali flats in project area.
Ivesia webberi	FT	N	N	No. Proposed project is outside geographic range.
Juncus luciensis	S	N	Y	No, potential habitat searched and species not found.
Lewisia cantelovii	S	N	N	No. No wet rocky cliff faces in project area, project elevation is too high.
Lewisia kelloggii ssp. hutchinsonii	S	N	Y	No, proposed project is outside geographic range.
Lewisia kelloggii ssp. kelloggii	S	N	Y	No, proposed project is outside geographic range.
Lomatium roseanum	S	N	Y	Yes.
Meesia uliginosa	S	N	N	No. No fens or peat soils in poroject area.
Mielichhoferia elongata	S	N	N	No seasonally moist rock outcrops in project area. Project elevation is too high.
Monardella follettii	S	N	N	No, no serpentine outcrops in the project area.
Monardella stebbinsii	S	N	N	No, no serpentine outcrops in the project area.
Oreostemma elatum	S	N	Y	No, potential habitat searched and species not found.
Packera (Senecio) eurycephala var. lewisrosei	S	N	N	No, no serpentine outcrops in the project area.
Packera (Senecio) layneae	FT	N	N	No, no serpentine in the project area. Project area is too high in elevation.
Penstemon personatus	S	N	N	No.Proposed project is outside known geographic range.
Penstemon sudans	S	N	N	No.Proposed project is outside known geographic range.
Phaeocollybia olivescens	S	N	N	No. Habitat model shows no medium or high quality habitat in project area.
Pyrrocoma lucida	S	N	N	No. No vernally moist meadows or alkali flats in project area.
Sedum albomarginatum	S	N	N	No, no serpentine outcrops in the project area.

[1]Status: FT = Federally listed Threatened, FC = Federal Candidate species, S = Forest Service Sensitive

Rare Species

The Plumas NF provides habitat for over 2,000 vascular plant taxa (Clifton 2003), which represent approximately 35 percent of the California flora (Hickman 1993). Of these, 51 taxa are on the Plumas NF Sensitive Species List.

- The only Federally Threatened plant species known to occur on the Plumas NF is *Packera layneae* (Layne's butterweed). This species grows in open rocky areas on gabbro and serpentine-derived soils that are between 650 and 3,300 feet in elevation. The Plumas NF has four occurrences, totaling approximately 12 acres. There is no suitable habitat and there are no occurrences in or near the project area.
- Two additional species of federal concern that have the potential to occur on the Plumas NF are the Federally Threatened *Orcuttia tenuis* (slender Orcutt grass) and the Candidate species *Ivesia webberi* (Webber's ivesia). *Orcuttia tenuis* is limited to relatively deep vernal pools with clay soil. *Ivesia webberi* is found in open areas of sandy volcanic ash to gravelly soils in sagebrush and eastside pine. No suitable habitat for slender Orcutt grass or Webber's Ivesia occurs within 100 feet of any proposed Rush Skeleton Weed Project treatment areas.

Existing Conditions Related to Direct and Indirect Impacts to Rare Species

There are no rare plant species known to occur within the project area or within 100 feet of the project area. All suitable habitats for rare plant species have been surveyed by PNF botanists. No sensitive or watch list species were found.

Environmental Consequences: Effects of Alternatives on Rare Plant Species

Surveys were done in 2013 and 2014. No sensitive or watchlist plant species were found. There would be no effect to rare plants if either alternative were implemented.

Determinations

It is my determination that both Alternatives would not affect sensitive plant species.

Specific Design Features or Mitigations

- If any TES Plant species found during the life of this project, an assessment would be done and mitigation measures would be implemented as needed.
- If the status of any TES plant addressed in this biological evaluation is changed an assessment would be done and any required mitigations, protections or monitoring would be reconsidered by the interdisciplinary team.
- Adhere to standard noxious weed prevention measures found below in the Noxious Weed Risk Assessment.

Noxious Weed Risk Assessment

Introduction

This Noxious Weed Risk Assessment (Risk Assessment) has been prepared to evaluate the effect of the Rush Skeleton Weed Project on noxious weeds listed by the California Department of Food and Agriculture (CDFA) and other invasive non-native plant species. This Risk Assessment documents potential effects from this project on noxious weed infestations. There is one noxious weed species, rush skeleton weed (*Chondrilla juncea*) known in the analysis area.

Non-proposed Action Dependent Factors

Inventory

The area of analysis for the noxious weed risk assessment includes the project area and surrounding land up to 1 mile outside the project boundary. Access routes to the project area were also considered in analyzing the risk of noxious weed infestation. The project area was surveyed for noxious weeds by PNF botanists in spring and summer of 2013 and spring of 2014.

Known Noxious Weeds

The California Department of Food and Agriculture's noxious weed list (http://www.cdfa.ca.gov) divides noxious weeds into categories A, B, and C. A-listed weeds are those for which eradication or containment is required at the state or county level. With B-listed weeds, eradication or containment is at the discretion of the County Agricultural Commissioner. C-listed weeds require eradication or containment only when found in a nursery or at the discretion of the County Agricultural Commissioner. There is one A-listed weed species, rush skeleton weed known in the analysis area. There are no B or C-listed weeds known to occur in the project area.

There one known occurrence of the A-listed weed species rush skeleton weed (*Chondrilla juncea*) in the analysis area is located alongside Eureka Creek at the Discovery Mine site. This occurrence (CHJU_034) is on both sides of the creek and on the north side of forest road 23N37. It is possible that it could be disturbed by vehicles involved in project activities.

This infestation covers approximately 0.5 acres. In May of 2013 an estimated 1000 plants were discovered. The site was visited several times in June, July and August of 2013 and an estimated 1200 plants were pulled or dug up and removed from the site. By mid-August of 2013 approximately 95% of rush skeleton weed plants found had been removed. The majority of the plants removed had not produced mature seeds. Some portion of the root of nearly every plant removed remained in the ground. This species is known to resprout from broken roots left in the ground (DiTomaso et al. 2013). All of the plants removed can be expected to resprout. The treatment effectively prevented seed production and therefore reduced the risk of spreading the infestation.

In September of 2013 after the first significant rain of the season new basal rosettes were found where plants had been removed. These were not treated but treatment by hand pulling or digging is planned for summer of 2014.

In May of 2014 many basal rosettes were found and approximately 20% had bolted. No flowers had been produced. Treatment in summer of 2014 will be by hand pulling and digging. Herbicide treatment may be done in 2015 depending on analysis and decision of the Rush Skeleton Weed Project.

Habitat Vulnerability

Vulnerability to noxious weed invasion and establishment is greatly influenced by plant cover, soil cover, and over story shade. The project area is predominantly characterized by Sierra mixed conifer, and montane chaparral, with some red fir, white fir, and Douglas-fir stands, montane hardwoods, riparian components. There are two wetland areas formed by springs that emerge from the ground within the project area.

In addition to the vegetation composition, past timber harvest, wildfire and associated suppression activities, historic mining, and recreational activity such as off-highway vehicle use and woodcutting have contributed to the risk of weed invasion within the project area. The area is commonly used for recreation. There are private lands immediately adjacent to the project area. Forest road 23N37 provides access to these inholdings. Historic mining, firewood gathering activities, and off-highway vehicle use have disturbed soil and resulted in a moderate-to- high vulnerability to noxious weed invasion. Due to the presence of the rush skeleton weed the entire project area is highly vulnerable to noxious weed infestation and spread. Any bare soil within the project area is particularly susceptible to noxious weed infestation.

Non-project Dependent Factors

Non-project dependent factors refer to activities other than the Rush Skeleton Weed Project and include: the Discovery Placer Exploration Project, existing roads, firewood gathering, and recreational activities including, camping, hiking, and hunting; and ongoing land management activities such as watershed restoration, timber harvest, and road maintenance.

The Discovery Placer Exploration Project proposes mining activities at the rush skeleton weed site. A Plan of Operations for that project has been submitted to the Plumas National Forest. The plan proposes to use a backhoe to dig 10 -20 pits down to bedrock. Pits are proposed to be 2-4 feet wide, up to 20 feet long and 5 – 15 feet deep. The proposed pits and processing area lie within the known infestation of rush skeleton weed. The Discovery Placer Exploration Project has not been implemented and is currently pending approval from by the Plumas National Forest.

Roads provide habitat by altering conditions, make invasion more likely by stressing or removing native species, and allow easier movement by wild or human vectors. Any activity that moves or agitates soil provides habitat favorable for the germination of noxious weed seeds. There is a high risk of spread of rush skeleton weed from non-project dependent vectors.

Proposed Action Dependent Factors

The Proposed Action is to treat the rush skeleton weed plants with herbicide and hand pulling. Revegetation with native forbs and grasses is also proposed. Vehicles and equipment used during the project activities can transport weed seeds or plant fragments. Disturbed soil is susceptible to noxious weed infestation. Hand pulling and digging of rush skeleton weed causes minor soil disturbance when compared to most forest management activities that commonly include use of heavy equipment, trailers and many vehicles. Herbicide spraying disturbs very little or no soil and does not directly add to risk of noxious weed invasion or spread. Both herbicide treatment and hand treatment of rush skeleton weed indirectly add to the risk because they would likely result in bare soil that is susceptible to noxious weed invasion.

The Standard Operating Procedures described below for washing of vehicles and equipment will be followed to reduce the risks described above.

Important to the introduction and spread of noxious weeds is the amount of soil disturbance and the amount of available sunlight. Many noxious weeds are early seral (i.e. pioneer) species that invade newly disturbed places with bare soils and ample sunlight. Activities that create these conditions are at risk of invasion. The more disturbance caused, the greater the area available for introduction, and thus the greater the risk. Therefore high disturbance activities are considered more at risk of invasion by noxious weeds than low disturbance.

Recommended Standard Operating Procedures (SOPs)

The SOPs are based on the priorities established in FSM 2900 discussed in the Analysis Framework section on page 3 of the Risk Assessment.

Recommended standard management requirements (SMRs) were developed in accordance with the direction set forth in FSM 2900, as well as the standards and guidelines in Appendix A of the ROD for SNFPA:

Prevention

1. Require all off-road equipment and vehicles (Forest Service and contracted) used for project implementation to be weed-free. Clean all equipment and vehicles of all attached mud, dirt and plant parts at a vehicle washing station or steam cleaning facility before the equipment and vehicles enter the project area. Cleaning is not required for vehicles that would stay on the roadway. In addition, clean all off-road equipment prior to leaving areas infested with noxious weeds.
2. Make every effort to ensure that all materials (i.e. gravel, fill, mulches, etc.) used on the NFS are free of invasive species and/or noxious weeds. Use onsite sand, gravel, rock or organic matter where possible. Encourage use of certified weed free hay and straw. Where states have legislative authority to certify materials as weed-free (or invasive free) and have an active State program to make those State-certified materials available to the public, rules shall be developed that restrict the possession, use, and transport of those materials unless proof exists that they have been State certified.

Control

3. Early Detection and Rapid Response (EDRR): Inventory and survey so as to quickly detect invasive species infestations, and subsequently implement immediate and specific actions to eradicate those infestations before they become established and/or spread. Coordinate detection and response with

internal and external partners. EDRR actions are grouped into three main categories: early detection, rapid assessment, and rapid response.

Restoration/Revegetation

4. Pro-actively manage aquatic and terrestrial areas of the NFS to increase the ability of those areas to be self-sustaining and resistant (resilience) to the establishment of invasive species. Where necessary, implement restoration, rehabilitation, and/or revegetation activities following invasive species treatments to prevent or reduce the likelihood of the reoccurrence or spread of invasive species.

5. Where restoration, rehabilitation, or revegetation activities are planned, use weed-free equipment, mulches, and seed sources. Avoid seeding in areas where revegetation will occur naturally, unless noxious weeds are a concern. Save topsoil from disturbance and put it back to use in onsite revegetation, unless contaminated with noxious weeds. All activities that require seeding or planting will need to use only locally collected native seed sources. Plant and seed material should be collected from as close to the project area as possible, from within the same watershed and at a similar elevation whenever possible. Persistent non-natives such as timothy, orchard- grass, or ryegrass will be avoided. This will implement the USFS Region 5 policy that directs the use of native plant material for revegetation and restoration for maintaining "the overall national goal of conserving the biodiversity, health, productivity, and sustainable use of forest, rangeland, and aquatic ecosystems".

Anticipated Weed Response to Proposed Action

Table 41 Summary of weed responses to risk factors for Rush Skeleton Weed Project

Factors	Variation	Risk
NON-PROPOSED ACTION DEPENDENT FACTORS		
1. Inventory	selected areas were surveyed	moderate
2. Known Noxious Weeds	Small population of high priority species	Moderate to high
3. Habitat vulnerability	moderate current disturbance, a high disturbance mining project is proposed at the site	Moderate current vulnerability; proposed mining project would create a high vulnerability to habitat
4. Non-project dependent vectors	Moderate current vectors; high risk vectors proposed in mining project	Moderate current risk; proposed mining project would create a high risk of spread by vectors
PROPOSED ACTION DEPENDENT FACTORS		
5. Habitat alteration expected as a result of project.	Low ground disturbance; moderate change in vegetative ground cover	Moderate
6. Increased vectors as a result of project implementation	vehicles used in implementation increase risk when compared to no action	Moderate
7. Mitigation measures	No SOPs measures implemented	High
	Some SOPs measures implemented	Moderately reduced
	All SOPs measures implemented	Greatly reduced

8. Anticipated weed response to proposed action	Some or no SOPs measures implemented	Moderate to high potential for significant increase in weed spread as a result of project implementation
	All SOPs measures implemented	Project is likely to result in a greatly reduced risk of spread of the known infestation. Low-to-moderate potential for weed spread as a result of project implementation.
9. Cost estimates	2014 Spraying, monitoring, and control 7 days GS 11 = $2184 2015 Spraying, monitoring, and control 7 days GS 11 = $2184	Generally, it is more economical and efficient to treat small infestations than to wait until they are too large.

Costs

Noxious weeds significantly reduce the value of public lands. Noxious weeds negatively impact timber production, grazing, wildlife habitat, and recreational opportunities. Any untreated or unknown noxious weed populations are highly likely to spread to nearby private lands. The known population of rush skeleton weed poses a threat to Plumas-Eureka State Park which lies one-half mile away. Noxious weed control is expensive and time consuming. Prevention and control of small infestations can reduce these impacts and reduce expenditures in the long run. Thus, noxious weed surveys, control of small infestations, and prevention measures are vital in reducing overall impacts and costs from noxious weeds. The estimates listed above in item 9. of Table 1 reflect the cost of implementing the proposed action. If this project were not implemented the future cost of controlling this weed is likely to be several times higher.

Specific Design Features or Mitigations

Monitor the project area in spring; identify and treat any newly found rush skeleton weed plants. Document and map changes in the rush skeleton weed population.

Mark the population boundary annually prior to treatment.

Summary

The project proposes to treat an existing noxious weed infestation. There are high-priority weeds located in the analysis area. The project area is currently at high risk of spread of the existing infestation. The required standard operating procedures listed above would be implemented to minimize the risk of spread due to project activities. The area is not likely to become more vulnerable to infestation as a result of these proposed activities.

Cultural Resources

Introduction

Cultural objects, historic structures and buildings, and archaeological sites are the material remains of our national heritage. Together they are known as heritage or cultural resources. The Plumas National Forest is responsible for, and committed to, protecting and managing these nonrenewable resources for current and future generations to understand and enjoy.

Environmental Consequences

Direct and Indirect Effects

Effects of Alternative 1 (No-action) on Cultural Resources

With no proposed activity, there would be no effect to cultural resources.

Effects of Action Alternatives on Cultural Resources

There will be no effect to cultural resources during the implementation of the proposed activities of the Rush Skeleton Weed project.

Cumulative Effects

There would be no direct or indirect effects to cultural resources from any of the alternatives therefore there would be no cumulative effects.

Legal Regulatory Compliance and Consultation

The Beckwourth Ranger District operates under a diverse array of local, state and federal management guidance and policy as well as various executive orders.

Currently, the Beckwourth Ranger District is guided by the Plumas National Forest 1988 Land and Resource Management Plan (LRMP) as amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) supplemental EIS and ROD.

Principle Environmental Laws

National Environmental Policy Act

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) requires that federal agencies rigorously explore and objectively evaluate all reasonable alternatives and briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 Code of Federal Regulations [CFR] 1502.14).

The project EA meets the CEQ regulations requiring public scoping and a thorough analysis of issues, alternatives and effects.

National Forest Management Act

The National Forest Management Act (NFMA) reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. The NFMA Act requires the Secretary of Agriculture to assess forest lands, develop a management plan for each unit of the National Forest System (NFS).

The Forest Service is complying with the provisions of this law by designing the project to meet the Standards and Guidelines of the Plumas Forest Plan and its amendments.

Endangered Species Act

The Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that any action authorized by a federal agency not be likely to jeopardize the continued existence of a threatened or endangered (TE), or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Section 7 of the ESA, as amended, requires the responsible federal agency to consult with the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service concerning TE species under their jurisdiction. It is Forest Service policy to analyze impacts to TE to ensure management activities are not be likely to jeopardize the continued existence of a TE, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. This assessment is documented in a Biological Assessment (BA) and is summarized or referenced in Chapter 3.

Wildlife and Fisheries

Consultation with USFWS

A list of T&E species was provided by the "Federal Endangered and Threatened Species that may be affected by Projects on the Plumas National Forest", updated December 15th, 2014, accessed via USFWS county list web page (http://www.fws.gov/sacramento/es_species/Lists/es_species_lists_NF-action-page.cfm) (Appendix A) was used for analysis. Based on the analysis conducted in the this BA/BE, it was determined that effects to a listed species would occur from implementation of the Rush Skeleton Weed Project, therefore consultation under Section 7 of the Endangered Species Act of 1973, as amended was required. The Decision Notice for the EA will not be signed or finalized until this consultation process is completed.

California Department of Fish and Game

Input specific to the Hayden project was solicited from the Department of Fish and Game through the public scoping process. However, since no input was received, all past advice from the Department was considered during the planning of the *p*roject.

Botany

The latest US Fish and Wildlife Service (USFWS) species list for Plumas County, in which the project occurs, was accessed from the USFWS website on May 27, 2014 (USDI 2014). This list fulfills the requirements to provide a current species list pursuant to Section 7(c) of the Endangered Species Act, as amended.

The only Federally Threatened plant species known to occur on the PNF is Packera layneae (Layne's butterweed). This species grows in open rocky areas on gabbro and serpentine-derived soils that are between 650 and 3,300 feet in elevation. The Plumas NF has four occurrences, totaling approximately 12 acres. There is no suitable habitat for this species within or near the Hayden Project area. Two additional species of federal concern that have the potential to occur on the Plumas NF are the Federally Threatened Orcuttia tenuis (slender Orcutt grass) and the Candidate species Ivesia webberi (Webber's ivesia). Orcuttia tenuis is limited to relatively deep vernal pools with clay soil. Ivesia webberi is found in open areas of sandy volcanic ash to gravelly soils in sagebrush and eastside pine. Based on field surveys, no suitable habitat for these two species occurs within the project area. In addition, no plants were found during field surveys. Therefore, no Threatened or Endangered species occur within the project area and a Biological Assessment is not required.

Clean Water Act

Section 208 of the Clean Water Act required the States to prepare non-point source pollution plans, which were to be certified by the State and approved by the Environmental Protection Agency (EPA). In response to this law and in coordination with the State of California Water Resources Control Board

(SWRCB) and EPA, Region Five began developing Best Management Practices (BMPs) for water quality management planning on National Forest System lands within the State of California in 1975.

The Hayden Project meets the Clean Water Act by implementing the Best Management Practices of the Soil and Water Conservation Handbook. By using BMPs, the Hayden Project meets this Act according to the ROD of the SNFPA (Section VII, ROD of the SNFPA).

Clean Air Act

The Clean Air Act provides the principal framework for national, state and local efforts to protect air quality. Under the Clean Air Act, the Office of Air Quality Planning and Standards is responsible for setting standards for pollutants which are considered harmful to people and the environment. The 1990 Clean Air Act is the most recent version of a law first passed in 1970.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act requires that the Forest take into account the potential effects of undertakings on historic properties (cultural resources) prior to initiating any actions that have the potential to effect such properties. For undertakings that are determined to have no effect on cultural resources, the Plumas National Forest (PNF) follows the process outlined in the "Programmatic Agreement among the U.S.D.A. Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation, Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act (NHPA) for Management of Historic Properties by the National Forests of the Pacific Southwest Region" (Programmatic Agreement) (USDA 2013).

The Rush Skeleton Weed EA meets the NHPA by protecting cultural resources by following the process outlined in the Programmatic Agreement. Therefore there will be "no effect" on cultural resources and the Forest would have taken into account the effect of the Rush Skeleton Weed project on cultural resource sites in compliance with Section 106 of the NHPA.

Executive Orders

Consultation and coordination with Indian Tribal governments, Executive Order 13175 of November 6, 2000

The following tribes were consulted during the NEPA scoping phase of the Hayden Project on February 13, 2013:

- Washoe Tribe of California and Nevada
- Susanville Indian Rancheria
- Greenville Indian Rancheria
- Maidu Summit Consortium

Indian Sacred Sites, Executive Order 13007 of May 24, 1996

Through scoping and consulting with local Native American tribes, it was determined by District Archeologist that the project may be implemented without further review or consultation.

Invasive species, Executive 13112 of February 3, 1999

Executive Order 13112 created the Invasive Species Council (ISC) in order to prevent the introduction of invasive species, provide for their control and minimize the economic, ecological and human health impacts that invasive species cause. Federal agencies are required to:

- Identify actions that may affect the status of invasive species
- Use relevant programs and authorities to prevent the introduction, control and monitoring of invasive species
- Provide for native species restoration as well as their habitats
- Promote public information
- Not condone or carry out actions that may spread invasive species
- Consult with the ISC and other stakeholders as appropriate

The project meets the Executive Order by following the noxious weed management Standards and Guidelines in Appendix A of the ROD for SNFPA. The SNFPA guidelines direct proactive management of noxious weeds that meet with the Executive Order. District botanists carried out the intent of the Executive Order and the noxious weeds Standards and Guides by:

- Identifying and controlling weed infestation areas
- Preventing the spread of noxious weeds through SOPs and site specific mitigation
- Educating the public regarding the presence and spread of noxious weeds

Floodplain management, Executive Order 11988 of May 24, 1977 and Protection of Wetlands, Executive Order 11990 of May 24, 1977

Executive Orders 11988 and 11990 require Federal agencies to avoid, to the extent possible, short- and long-term effects resulting from the occupancy and modification of flood plains and the modification or destruction of wetlands. These executive orders are intended to preserve the natural and beneficial values served by floodplains and wetlands.

The project meets these executive orders by implementing the Best Management Practices (BMP) of the Soil and Water Conservation Handbook. By using BMPs, the project meets the executive orders according to the ROD of the SNFPA (Section VII, ROD of the SNFPA).

Environmental Justice, Executive Order 12898 of February 11, 1994

Executive Order 12898 requires that Federal agencies make achieving environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of their programs, policies and activities on minority and low-income populations.

Although low-income and minority populations are within the vicinity of the project, activities associated with the Project would not discriminate against them. Proposed activities would not adversely affect community, social, economic and health and safety factors. Public scoping was conducted in accordance with NEPA regulations to identify any potential issues or hazards associated with the project.

Special Area Designations

The selected alternative will need to comply with laws, regulations and policies that pertain to the following special areas:

Research Natural Areas

There are no Research Natural Areas with the Hayden Project Area.

Inventoried Roadless Areas

There are no Inventoried Roadless Areas within the Hayden Project Area.

Wilderness Areas

There are no Wilderness Areas within the Hayden Project Area.

Wild and Scenic Rivers

There are no Wild and Scenic Rivers in the Hayden Project Area.

Municipal Watersheds (FSM 2540)

There are no Municipal Watersheds in the Hayden Project Area.

Consultation and Coordination

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

Interdisciplinary Team Members:

Interdisciplinary Team Leader – Michael Friend

Environmental Planner – Kyla Sabo

Botany – Michael Friend

Cultural Resources – Mary Kliejunas

Soils and Hydrology – Antonio Dueñas

Wildlife – Russell Nickerson

FEDERAL, STATE, AND LOCAL AGENCIES:

Government Agencies and Community Organizations:

California Department of Fish and Wildlife; California Department of Water Resources; Central Valley Regional Water Quality Control Board; and USDA-FS Pacific SW Region 5- Anne Yost and Anton Jackson.

<u>TRIBES</u> Formal consultation was initiated with the following tribes:

Greenville Rancheria

Washoe Tribe of California and Nevada

Susanville Indian Rancheria

Maidu Summit Consortium

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Appendix A: Maps

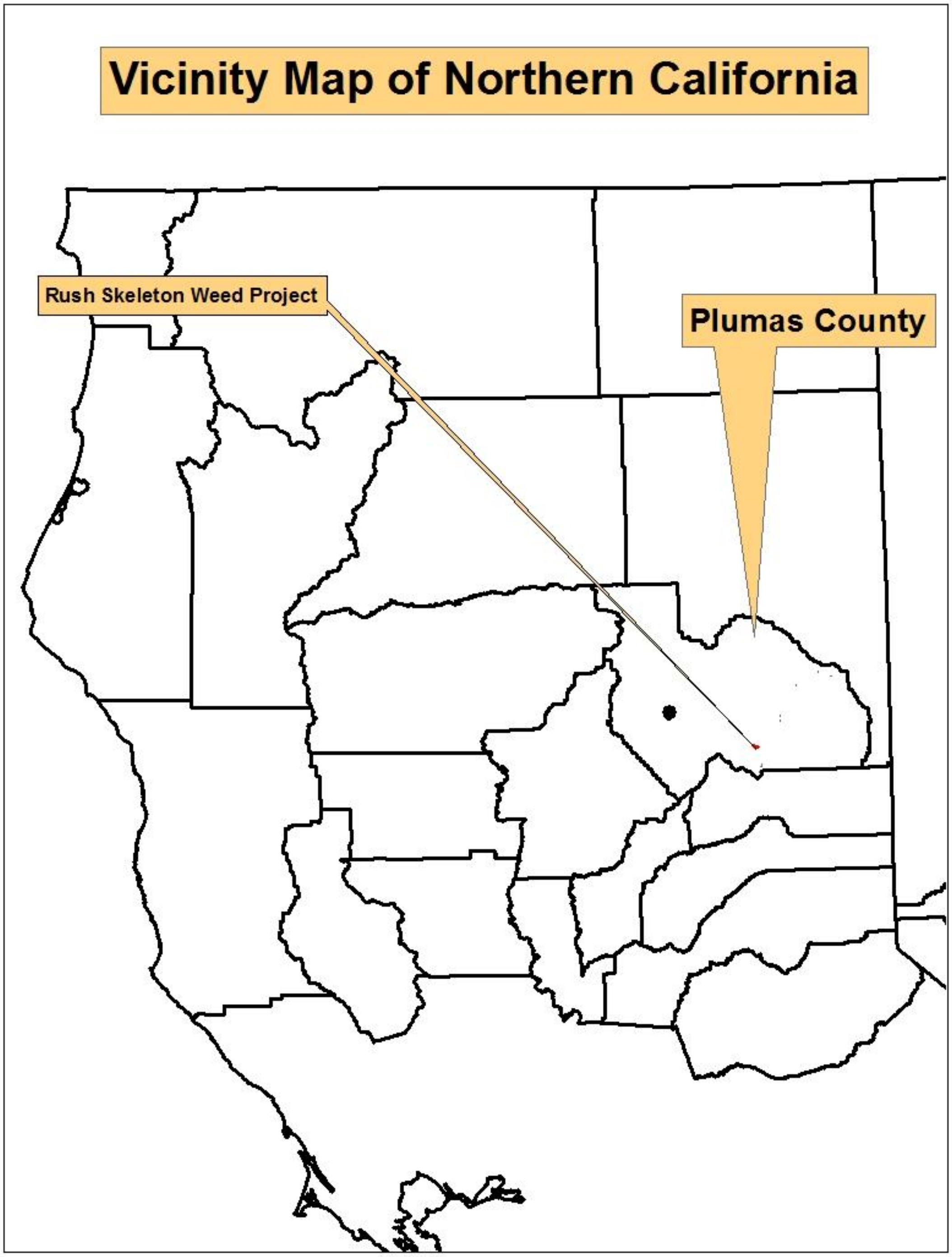

Figure A 1. Vicinity map The Vicinity map (Figure A1) shows the location of the Rush Skeleton Weed relative to the Plumas National Forest in Northern California. showing the Rush Skeleton Weed in relation to landmarks on the Plumas National Forest.

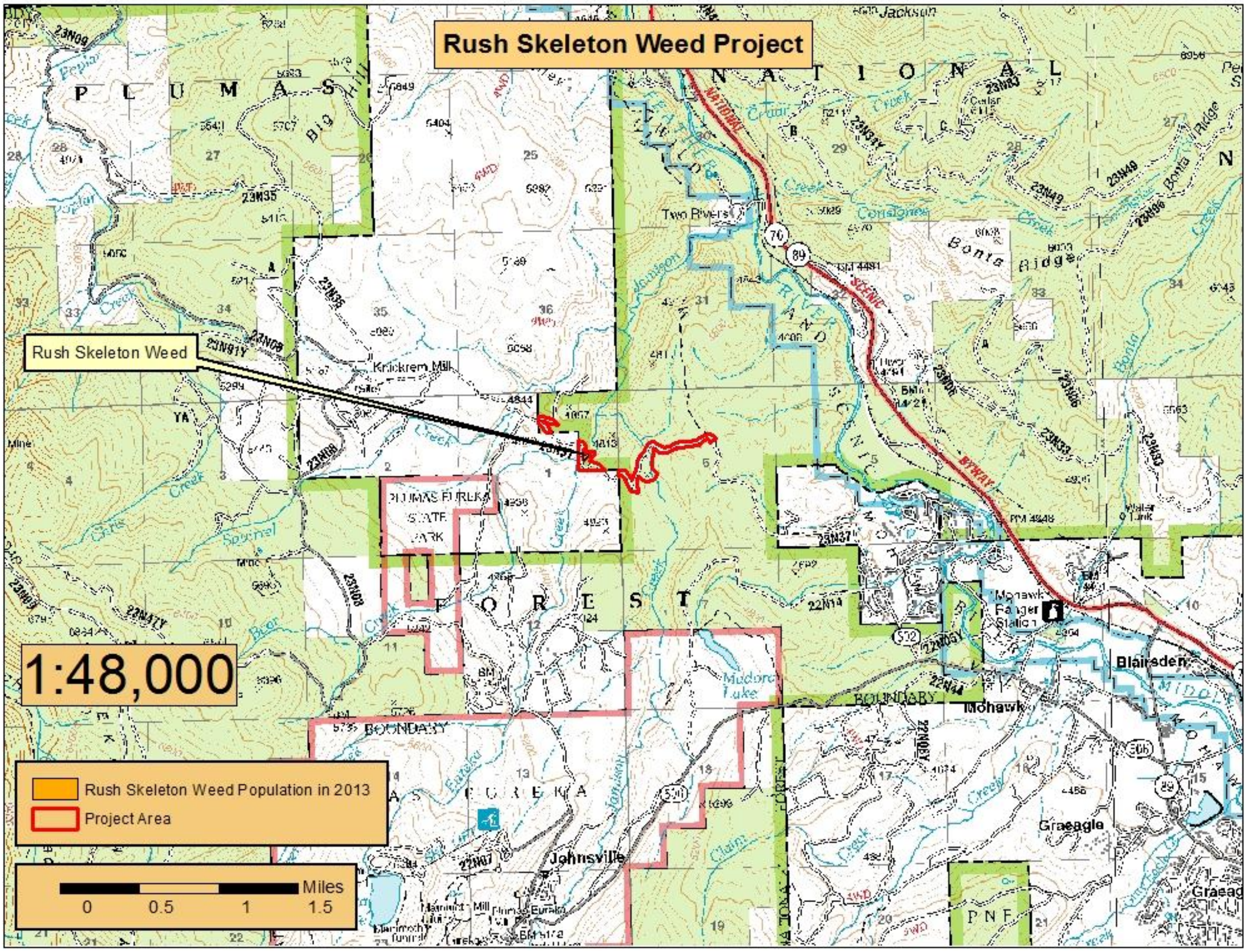

Figure A 2 Map showing the three treatment areas in the Proposed Action.

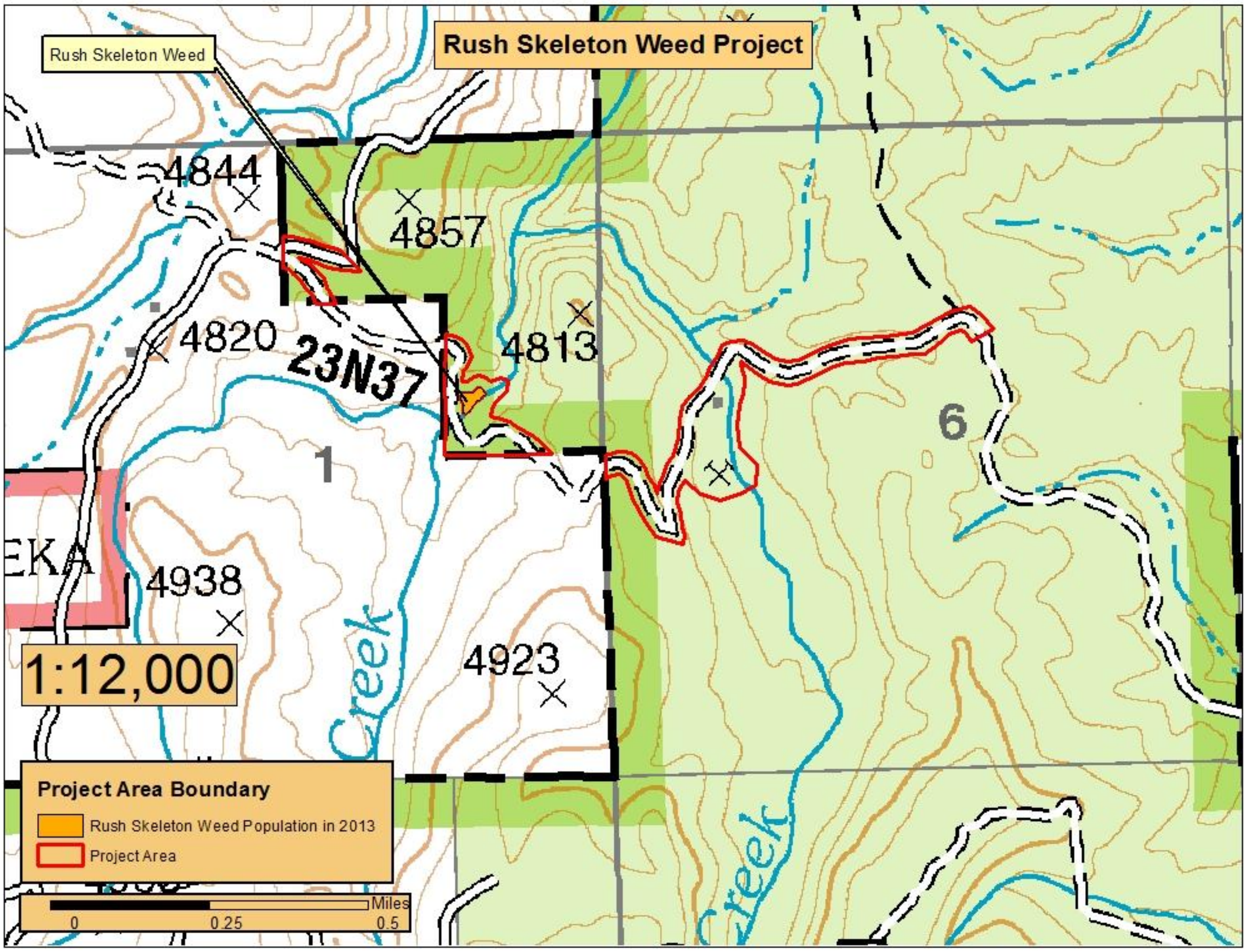

Figure A 3 Project Area shows the Proposed Action for the Rush Skeleton Weed Project, including three treatment areas. Two of these treatment areas are not currently infested and would be treated only if the noxious weed is found there in the future.

Appendix B: Response to scoping comments

An issue is a point of debate, dispute, or disagreement regarding anticipated effects of the Proposed Action. Issues have a cause-effect relationship to the actions under consideration. An issue statement describes a specific action and the environmental effect(s) expected to result from that action. Cause-effect statements provide a way to understand and focus on the issues relevant to a particular decision. Issues serve to highlight effects or unintended consequences that may occur from the Proposed Action and alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand. Issues are identified during scoping early in the process to help set the scope of the actions, alternatives, and effects to consider.

The interdisciplinary team reviewed scoping comments received from three individuals or groups. Issues are not tracked in the Environmental Assessment for any of four reasons: 1) The issue is outside the scope of the Proposed Action; 2) The issue is already decided by law, regulation, Forest Plan, or other higher level decision; 3) The issue is irrelevant to the decision to be made; or 4) The issue is conjectural and not supported by scientific or factual evidence. NEPA does not require these types of issues to be addressed in the EA, but they do need to be identified and addressed somewhere. This document serves that purpose.

The following list identifies those who commented, and assigns a number to each scoping comment letter.

Scoping Commenter	Assigned Number
Candy and Bob Bennett	1
Tim Arrowsmith	2

For ease of categorizing responses to comments or issues in the above letters, they will be referred to as letters 1, 2, and 3. Issues within the letters are sequentially numbered (i.e. 1-1, 1-2, 2-1, etc.).

Appendix C: Safety and Spill Management Plan

Introduction

This spill plan outlines the specific actions to take to prevent or manage any spill or injury involving the use of pesticides on the Mt. Hough Ranger District of the Plumas National Forest. This plan also describes procedures for the transport, storage, handling, and disposal of pesticides during the implementation of a pesticide project.

This plan is tiered to and supplements the following documents:

- Forest Service Handbook (FSH) 2109.14.

  Pesticide spill prevention and clean-up, as well as storage, transport, and disposal procedures are covered in detail in Forest Service Handbook (FSH) 2109.14 Pesticide-Use Management and Coordination Handbook

- Forest Service Health and Safety Code Handbook 6709.11.

  The Forest Service Health and Safety Code Handbook (pages 20-18 through 20-21 and 60-50 through 60-52) address safety procedures to be followed by employees while dealing with pesticides.

- Sierra Cascade Province, Lassen, Modoc and Plumas National Forests, Safety and Health Program Plan, June 2, 2009.

  The Sierra Cascade Province Safety Plan provides information and procedures relating to hazardous materials in sections 19 (Hazardous Chemicals) and 21 (Training - Hazardous Materials).

- Plumas National Forest Beckwourth Ranger District Hazard Communication Plan (2009)

  The Plumas National Forest Hazard Communication Plan discusses workers' right to know, hazardous chemicals, Material Safety Data Sheets (MSDS), storage, labeling, training, notification procedures, and reporting spill related accidents.

- Specimen labels and material safety data sheets (MSDS)

  The specimen labels and Material Safety Data Sheets for the chemicals proposed for use in this project contain additional safety precautions and procedures in case of accidental exposure or spill. Copies of the above plans, specimen labels, and MSDS are located in the project file.

Pesticide Safety

Training/Licensing

1. Forest Service personnel crews must be supervised by a person certified as Qualified Applicator (QAC or QAL). All employees must receive any training that is required under federal, state, and local laws for the chemicals they are applying.

2. A safety training session will be held before any work starts. A job hazard analysis will also be prepared and reviewed before work starts.

Transportation of pesticides

Although the pesticides that would be used for control of noxious weeds and root disease are not highly toxic, our commitment to safety dictates that caution must be taken when transporting Pesticides.

1. Forest Service personnel will be required to purchase and transport all pesticides in compliance with Federal and State regulations.
2. It is essential to take all possible steps to prevent damage to containers to ensure no leaks develop.
3. Special precautions must be taken while loading and unloading pesticide containers on and off vehicles. Containers should be loaded so none can move, roll, or fall during travel periods. It is particularly important to ensure no container could fall from a vehicle.
4. Open containers must never be transported. Partly used containers must be securely resealed before movement.
5. Transportation routes should be carefully chosen to limit the number of stream crossings and routes adjacent to stream courses.
6. No more pesticide should be transported than what is estimated to be needed to complete the day's work. Pesticide mix is to be batched at each unit or at a designated batching area. No more pesticide other than what is estimated to be needed for that unit should be batched. This will reduce the amount of pesticide concentrate and mix that is transported to the project area and between units. This will reduce the amount of material spilled should an accident occur.
7. After transportation, all pesticide containers should be inspected for leaks, and the vehicle should be carefully examined for contamination.
8. Unless properly cleaned prior to use, vehicle compartments used to transport pesticides must never be used to transport food, clothing, beverages, household goods, animal feed or similar commodities.
9. All containers, including service containers, must be properly labeled to identify the pesticide.
10. All transport vehicles must be placarded and manifested as required by the U.S. Department of Transportation. A copy of the manifests must be present in the vehicle and must be available for inspection.

Storage of pesticides

During field application, pesticides not being actively used for mixing or application are required to be securely locked in a vehicle compartment.

General safety procedures for mixing and application

Although the pesticides that would be used are not highly toxic, a good habit to develop is treating them as if they are dangerous chemicals. This cautious approach will minimize exposure and contamination.

1. Routes of Possible Exposure. Pesticides can enter the body by one or more of four direct exposure routes. All personnel involved with spraying operations will be advised of these possible routes of exposure.

    a. Oral: This represents a serious potential for contamination. Chemical may be splashed into the mouth while pouring, measuring, or mixing operations. Also by licking the lips, rubbing the mouth, or smoking, eating, or drinking with contaminated hands and fingers.

    b. Dermal: This is usually the primary route of exposure. Although face, neck, armpits, and genitals will absorb chemical more easily, the hands usually have the highest exposure.

    c. Cuts and Abrasions: Chemical may be absorbed very quickly in the blood stream through these surfaces.

    d. Respiratory: The pesticide used in this project is a dry flowable (a.k.a. wettable powder) formulation, which poses a greater inhalation risk than liquid herbicide formulations. Respiratory exposure can be minimized by careful mixing, and the pesticide solution does not pose a larger-than-normal risk once it is mixed with water. However, absorption of pesticides is at a maximum through respiratory exposure, as almost all of the contaminant inhaled is absorbed internally.

2. General Personal Hygiene All inspectors, applicators, and mixers will wear fresh coveralls every day and will rinse gloves, boots and any other contaminated safety clothing at the job site at the end of each working day. All persons shall wash before eating or handling foods, drinking, smoking, or using the restroom.

3. Personal Protective Equipment The purpose of personal protective equipment is to prevent pesticides from contacting the body and clothing. This equipment also protects the eyes and prevents inhaling toxic chemicals. Personal safety equipment is effective only if it fits correctly, is used properly, and is kept cleaned and maintained. Label requirements for personal protective equipment are the minimum required, but you should select equipment that offers maximum protection. All personal protective equipment designated for pesticide projects will be specific for those uses and will not be worn or used for other purposes. The Forest Service will be required to furnish water, soap, and disposable towels in sufficient quantities for all Forest Service employees, as well as eyewash facilities or canteens of water for washing eyes. Contractors will be required to furnish these items for their employees. Disposal of contaminated equipment must be done with the same caution as accorded the active ingredient of the pesticide that it was contaminated with and done in accordance with State of California and Federal EPA regulations. The type and amount of personal protective equipment required for employees is related to the type of work that being done and the risk of exposure to a pesticide. The following lists of personal protective equipment are required for the corresponding

task involved in pesticide use. Where changes in label or law require additional safety equipment, these changes will be carried out for this project.

a. Handling/Loading/Unloading Concentrate
   - disposable or washable coveralls with a “Danger” rating on the Label.
   - chemical splash proof goggles
   - rubber gloves

b. Mixer/Loader
   - hard hat (without leather head band)
   - full face shield or chemical splash proof goggles
   - disposable or washable coveralls with a “Danger” rating on the Label.
   - rubber gloves
   - boots or overshoes
   - rubber apron (when mixing Category 1 or 2 Pesticide)

c. Applicator
   - hard hat (without leather head band)
   - chemical splash proof goggles or safety glasses
   - washable or disposable coveralls with a “Danger” rating on the Label.
   - rubber gloves
   - sturdy leather shoes and socks
   - canteen of water for washing eyes or portable eyewash kit on person

4. Public Safety

   a. All treatment units and the immediately surrounding area will be checked for members of the public immediately prior to application. Unauthorized persons will be asked to leave.

   b. For streamside management zones or riparian habitat conservation areas (RHCA), the buffer strips described in the management requirements of the environmental document shall be adhered to.

   c. The management requirements listed in the environmental document, specimen labels, and MSDS will be followed to reduce off site movement, drift, or volatilization.

Disposal of empty pesticide containers

1. All empty containers and unused amounts of pesticides must be securely held in a safe and secure pesticide storage area until reuse or proper disposal can occur.

2. A regular system of disposal is necessary and empty containers should not be allowed to accumulate.
3. Disposal hazards can be reduced by:
    - Carefully calculating the required pesticide quantities needed so any possible disposal is kept to a minimum;
    - Immediately after emptying a container, rinse 3 times with the diluents used for mixing and pour the rinse into the spray tank load for distribution. Also wash the outside of the container. Volume of rinse should be 10 percent of the volume of the container for each rinse.
4. The containers must be disposed of ONLY at approved landfills.
5. Arrangements for disposal need to be made in advance of the delivery of the containers to allow the disposal site operator to have the necessary equipment available to crush and bury the containers.

Pesticide spill and accident procedures

Notification procedures for reporting accidents or incidents involving pesticides

Spill accidents are categorized as emergency or non-emergency. A spill is defined as an emergency if it moves off site and threatens water supplies or is otherwise potentially harmful to human health or the environment.

If a spill of any quantity occurs, contact the **Plumas National Forest Dispatcher**.

1. Notification Numbers
    - Plumas National Forest (PNF) Dispatcher **- (530) 283-7854**. If no answer, call **911**.
    - PNF Hazmat Response Coordinator – Chris Pennington **(530) 394-8242**
    - Forest Pesticide Use Coordinator – Ryan Tompkins (**530) 283-7841**
    - Plumas National Forest Safety Officer – (**530) 283-7761**
2. All accidents or incidents resulting from Pesticide use are to be reported to the Forest Dispatcher who will notify the District HAZMAT Coordinator and Forest Pesticide Use Coordinator. The following information should be given to the Dispatcher.
    a. Name of project.
    b. Location of spill.
    c. Name of chemical spilled.
    d. Estimate of how much was spilled.
    e. Nature of the spill.
3. The report will be by telephone when possible. Radio communication will be used as backup to the Forest Dispatcher then to Forest Pesticide Use Coordinator.

4. The R-5 "Report of Accidental Discharge" Form will be completed for ALL spills regardless of size, with a copy sent to the Supervisor's Office, attention Forest Pesticide Use Coordinator. Keep a copy on the District in a permanent file. Make sure it shows the date completed and is signed.
5. A follow-up written report covering all details of the accident will be submitted immediately to the Forest Pesticide Use Coordinator. All aspects of the accident or incident should be covered in the written report.
6. Items to be included in the report are:
    a. Names of people involved.
    b. Location of accident or incident.
    c. Date of accident or incident.
    d. Type of accident or incident.
    e. Estimated quantity of spill.
    f. Name and manufacturer of Pesticide involved.
    g. Formulation of Pesticide.
    h. Weather information at time of accident or incident.
    i. A detailed narrative statement explaining how the accident or incident occurred and what actions were taken.

List of poison control centers

Notify the dispatcher of any poisoning occurring on the job site. The dispatcher will ensure that emergency medical personnel respond to the incident. Try to determine the type of poisoning and symptoms and relay the information to the dispatcher. The following is a list of poison control centers that can be contacted should acute poisoning occur.

IF IN DOUBT AS TO THE EXPOSURE LEVEL, CALL THE POISON CONTROL CENTER

1. Poison Control Centers

    The California Poison Control System:
    24-Hour Emergency Phone: 1-800-222-1222
    The California Poison Control System is managed by the University of California San Francisco, School of Pharmacy consisting of four answering sites:
    - Sacramento Division; UC Davis Medical Center
    - San Francisco Division, San Francisco General Hospital
    - Fresno/Madera Division; Valley Children’s Hospital
    - San Diego Division, UC San Diego Medical Center

    The answering site closest to the project area is the:
    Sacramento Division; UC Davis Medical Center
    2315 Stockton Boulevard

Sacramento, CA 95817
Emergency Phone: (800) 222-1222
Telephone: (916) 227-1400
Fax: (916) 227-1414

2. Local Hospitals & Medical Clinics
   Eastern Plumas District Hospital, 500 First Ave., Portola, CA 96122, **(530) 832-6500**
   Plumas District Hospital, 1065 Bucks Lake Rd., Quincy, CA 95971, **(530) 283-2121**
   Enloe Medical Center, 1531 Esplanade, Chico, CA 95926 (530) 332-7300 /(800) 822-8102
   Greenville Medical Clinic, 176 Hot Springs Road, Greenville, CA (530) 284-6116

3. Non Acute Illness-Environmental Exposure from Drift, Contaminated Water, or Food.

   Mimi Hall, Director
   Plumas County Department of Public Health
   270 County Hospital Rd., Suite 206, Quincy, CA 95971
   (530) 283-6330, FAX (530) 283-6425

   Jerry Sipe, Director
   Plumas County Department of Environmental Health
   270 County Hospital Rd., Suite 127, Quincy, CA 95971
   (530) 283-6355, FAX (530) 283-6441

Procedure for containment and clean-up of pesticide spills

1. In the event of accidental spill, the objective is to take immediate action, in a safe manner, to minimize the spill contamination until specialized personnel and equipment arrives.

2. If the spill involves a vehicle accident, determine the extent of any possible injuries and notify the dispatcher so that emergency medical equipment and personnel can be dispatched. Threats to human life are a priority over spill containment and cleanup. NOTE: The degree of urgency for environmental monitoring is directly related to the amount of pesticide spilled and its location.

3. In the event of a spill due to a vehicle accident, the applicator (Forest Service or contractor) shall:

   a. Eliminate fire danger and administer first aid to seriously injured victims.

   b. Put out flaggers or flares to prevent additional accidents. Be careful using flares around spilled material.

   c. Try to prevent the material from entering waterways.

   d. Determine:

      - The chemical spilled.
      - Date and time of spill.
      - If in water, stream name and exact location.
      - An estimate of the amount spilled.
      - The concentration (i.e. if the spilled material is concentrate or mixed chemical).

e. Control traffic if necessary.

4. In the event of a non-vehicle accident-related spill, the applicator shall:

   a. Prevent ignition of flammable material by eliminating sources of ignition such as exhausts, electric motors, gasoline engines, or cigarettes.

   b. Take immediate action to stop the spill by either plugging the leak or doing whatever is safely possible to ensure the spill is stopped from coming out of the source container. Only properly trained and certified personnel may handle the pesticides. Consistent with employee qualifications, confine the spill to prevent it from spreading. Encircle the spill area with a dike of absorbent material such as kitty litter for water soluble pesticides, or construct an earthen berm. If necessary, dig a ditch to direct the spill flow away from sensitive areas. Consistent with employee qualifications, cover the spill with an absorbent material if the spill is liquid; if the spill is dry chemical, cover with a plastic tarpaulin and secure. (Note: Used absorbent materials must be disposed of as required by law.)

   c. Take immediate action to contain the spill by temporarily diverting it from water sources into a local ponding area. If needed, secure available equipment to build ponding areas so the spill does not reach waterways.

   d. If efforts to contain the spill fail and the spill enters a waterway, immediate notice of the spill should be given to the Forest Dispatcher so corrective action can be taken as soon as possible.

   e. Separate leaking container(s) from other containers.

   f. Prevent unprotected personnel from entering the spill area.

   g. Do not wash the spill into a ditch, drainage, stream, sewer drain, or off the road, since this serves to further spread the chemical.

   h. Use safe removal procedures. Use certified hazardous waste transportation firms and disposal facilities when appropriate. Utilize manufactures disposal recommendations and safe regulations for determining the best removal and disposal for specific quantities and chemicals.

      - Transport waste to approved dumping area using EPA and state approved containers and methods.
      - Contaminated soil will be disposed of as hazardous waste.
      - Decontaminate tools, vehicles, concrete slabs, and any other object coming in contact with the chemical. Scrub thoroughly and follow with a clean water rinse. Provide for appropriate disposal of decontamination fluids.

- Inspect the surrounding area for possible contamination and leave entire area safe for the public and wildlife.

Spill kit equipment

The contractor is required to maintain a spill kit on site for each application crew at all times. The contractor shall provide a spill kit equipment list to the Forest Service. Spill kit contents shall be approved by the Forest Service Contracting Officer (CO). Depending upon pesticides used, some recommended items include:

1. Personal protective equipment (PPE)
    - 1 pair rubber or neoprene boots or overshoes (when required by label)
    - 2 pair rubber or neoprene gloves
    - 1 pair chemical splash proof goggles
    - 1 respirator and spare cartridges (when required by label)
    - 1 pair chemical splash proof coveralls for pesticides with a “Danger” rating on the Label.
    - 1 portable eyewash
    - 1 pint of liquid detergent
2. Spill cleanup equipment
    - 2 push brooms
    - 1 dustpan
    - 1 shop brush
    - 1 round point shovel
    - 1 square point shovel
    - 1 polyethylene or plastic tarp
    - Polyethylene bags with ties.
3. Spill containment
    - Instructions on how to deal with spill.
    - Powersorb spill kit with safe and send salvage drum (kit contains universal absorbents in boom, roll, and pad form)
    - twenty five pounds of absorbent material such as kitty litter
    - 1 container of epoxy sealer (to plug leaking containers)
    - Twenty five pound bag of lime (acid neutralizing agent)

4. Public Safety
    - Cellular phone, handheld radios for traffic control
    - Traffic direction hand signs (slow/stop paddles)
    - Reflectors or road flares
    - High visibility traffic direction vests
    - 1 ABC type fire extinguisher

List of hazmat cleanup companies

Following is a list of private HAZMAT clean-up companies that may be contacted in case of a large emergency spill. The contractor is responsible for spill cleanup. In the event that the contractor does not perform his/her obligations the dispatcher or Forest or District HAZMAT Coordinator will contact a HAZMAT clean up company to initiate cleanup. This list is provided as a reference.

- American Integrated Services, Inc.; Northern California Office: (888) 423-6060 or (707)-427-2234
- PARC Environmental: (559) 233-7156
- Engineering/Remediation Resources Group; San Francisco: (415) 395-9974 or Sacramento: (916) 520-7270
- National Response Corporation Chico, CA Office
  Phone: (530) 343-5488; 24-Hour Emergency Number: (800) 343-3488

LIST OF PHONE NUMBERS

Notification

- Plumas National Forest (PNF) Dispatcher - **(530) 283-7854**. If no answer, call **911**.
- PNF Hazmat Response Coordinator – Chris Pennington **(530) 394-8242**
- PNF Pesticide Use Coordinator – Ryan Tompkins (**530) 283-7841**
- PNF Safety Officer – Lee Mercer (**530) 283-7761**

Other useful phone numbers

Plumas National Forest, Supervisor's Office- **(530) 283-2050**

Plumas National Forest, Beckwourth Ranger District **– (530) 836-2575**

California Highway Patrol, Quincy – **(530) 283-1100**

California Highway Patrol, Susanville – **(530) 257-2191**

Plumas County Sheriff, Dispatch – **(530) 283-6300**

Plumas County Sheriff, Greenville Office – **(530) 284-7222**

Plumas County Hazardous Materials Team – Robbie Cassou **(530) 283-6332**

Plumas County Agricultural Commissioner – Tim Gibson **(530) 283-6365**

Poison Control Centers

The California Poison Control System:
24-Hour Emergency Phone: (800) 222-1222

Sacramento Division; UC Davis Medical Center
Emergency Phone: (800) 876-4766
Emergency Phone for Hearing Impaired: (800) 972-3323

Hospitals & Health Clinics

Plumas District Hospital, 1065 Bucks Lake Rd., Quincy, CA 95971, **(530) 283-2121**

Eastern Plumas District Hospital, 500 First Ave., Portola, CA 96122, **(530) 832-6500**

Enloe Medical Center, 1531 Esplanade, Chico, CA 95926, **(530) 332-7300**

Greenville Medical Clinic, 176 Hot Springs Road, Greenville, CA **(530) 284-6116**

Lake Almanor Clinic, 199 Reynolds, Rd, Chester, CA (530) 258-4256 or 258-1986

County Health Departments

Mimi Hall, Director, Plumas County Department of Public Health
270 County Hospital Rd., Suite 206, Quincy, CA 95971
(530) 283-6330, FAX (530) 283-6425

Jerry Sipe, Director, Plumas County Department of Environmental Health
270 County Hospital Rd., Suite 127, Quincy, CA 95971
(530) 283-6355, FAX (530) 283-6441

Jim Perez, Hazardous Materials Specialist, **(530) 283-6355**

Appendix D: Present and future foreseeable projects

According to the Council on Environmental Quality (CEQ) NEPA regulations, "cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR § 1508.7).

In order to understand the contribution of past actions to the cumulative effects of the Proposed Action and alternatives, this analysis, with the exception of hydrology relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the Proposed Action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions may ignore the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." For these reasons, the analysis of past actions in this section is based on current environmental conditions.

Most of the specialists use the aforementioned cumulative effects analysis rationale, with the exception of watershed, where past actions over a 30-year period are used as an input to the Equivalent Roaded Acre analysis model. A list of past treatment types, year and acres are provided in Table D1.

The cumulative effects analysis areas vary depending on the specialist doing the analysis. Botany, Soils, Cultural Resources, and Wildlife use the Project area, which is the boundary of the MPFF Allotments. The analysis area for the Hydrology report is larger than the Project area, as it uses the combined area of watersheds that contain land situated in the MPFF Allotments. Noxious weeds are analyzed using a one-mile buffer around the project area.

Table D1 is a compilation of the relevant past, present, and future-foreseeable actions that may occur within the largest combined extent of all of the cumulative effects analysis areas.

Table D1 Relevant Past, present and future foreseeable projects within the Rush Skeleton Weed Project area.

Project Name	Year	Acres	Treatment Type	Misc.
Hayden Project area				
Present and Future-Foreseeable Projects				
Discovery Placer Exploration Project	**2014**	**2**	**Mining**	**Plan of Operations has been submitted to PNF.**
Squirrel Creek Mine and Extension #1 Placer Exploration and Testing	**2015**	**Undetermined**	**Mining**	**Plan of Operations has been submitted to PNF.**
Plumas Eureka Project	**2015**	**Undetermined – estimated to treat 1500 acres.**	**DFPZ, Area Thin and Group Selection**	**Project is within Wildland Urban Interface in and around Blairsden/Plumas-Eureka/Johnsville.**
Big Hill Project	**2014 - 2018**	**5,230**	**DFPZ, Area Thin and Group Selection**	
Jackson Project	**2014**	**19,986**	**DFPZ, Area Thin and Group Selection**	
Recreation	**Ongoing**			**Dispersed camping, hunting, fishing, hiking, mining and OHV use.**
Fuelwood Gathering	**Ongoing**	**Entire District**		**Typically cord wood consists of down logs within the forest, along forest roads, and within cull decks created by past logging operations, or as standing snags.**
Christmas Tree Cutting Program	**Ongoing**	**Entire District**		**This consists of the trees ≤ 6 inches in diameter (measured at the ground) being removed generally along or within a short distance from open roads.**
Extended Boundary				
Present and Future Foreseeable Projects				
Freeman Timber Sales (Decision 2006, Freeman Project EIS)	**Started 2006, not all implemented**	**1,124 acres**	**DFPZ, Area Thin and Group Selection**	•
Jackson Project	**2014 and ongoing**	**19,986 acres**	**DFPZ, Area Thin and Group Selection**	•
Fuelwood Gathering	**Ongoing**	**Entire District**		**Typically cord wood consists of down logs within the forest, along forest roads, and within cull decks created by past logging operations, or as standing snags.**
Christmas Tree Cutting Program	**Ongoing**	**Entire District**		**This consists of the trees ≤ 6 inches in diameter (measured at the ground) being removed generally along or within a short distance from open roads.**

Appendix E: Best Management Practices

Land management activities have been recognized as potential sources of non-point water pollution. By definition, non-point pollution is not controllable through conventional treatment plant means. Containing the pollutant at its source or precluding delivery to surface water controls non-point pollution. Sections 208 and 319 of the Federal Clean Water Act, as amended, acknowledge land treatment measures as being an effective means of controlling non-point sources of water pollution and emphasizes their development.

Working cooperatively with the California State Water Quality Board, the Forest Service has developed and documented non-point pollution control measures applicable to National Forest System Lands. Following evaluations of the control measures by State Water Quality Board personnel as they were applied on site during management activities, an assessment of monitoring data, and the completion of public workshops and hearings, the Forest Service's measures were certified by the State and approved by the Environmental Protection Agency as the most effective means the Forest Service could implement to control non-point source pollution. These measures were termed "Best Management Practices" (BMP's). Best Management Practice control measures are designed to accommodate site-specific conditions. They are tailor made to account for the complexity and physical and biological variability of the natural environment. In the 1981, Management Agency Agreement between the State Water Resources Control Board and the Forest Service, the State agreed that; "The practices and procedures set forth in the Forest Service document constitute sound water quality protection and improvement on National Forest System lands". The implementation of BMP's is the performance standard against which the successes of the Forest Service’s non-point pollution water quality management efforts are judged. Below is a listing of Region 5’s Best Management Practices (BMP 5.7 to BMP 5.13) and the National Core Best Management Practices (Chem-1 to Chem-6) that would guide the activities associated with the Rush Skeleton Weed project.

Region 5 Best Management Practices

BMP 5.7: Pesticide Use Planning Process

Objective: To introduce water quality and hydrologic considerations into the pesticide use planning process.

Explanation: The pesticide use planning process is the framework for incorporating water-quality protection requirements contained in BMPs 5.8 through 5.14 into project design and management. The project environmental document will incorporate these considerations in discussion of environmental effects and mitigation measures.

Implementation: The interdisciplinary team will evaluate the project in terms of site response, social and environmental impacts, and the intensity of monitoring needed.

The responsible line officer will prepare environmental documentation, project plan, and the safety plan. Project plans and safety plans will specify management direction.

Approval for proposed pesticide projects will proceed according to direction established in Pacific Southwest Region supplement No. 2100-95.1 to 2150.

BMP 5.8: Pesticide Application According to Label Directions and Applicable Legal Requirements

Objective: To avoid water contamination by complying with all label instructions and restrictions for use.

Explanation: Directions on the label of each pesticide are detailed and specific, and include legal requirements for use.

Implementation: Constraints identified on the label and other legal requirements of application must be incorporated into project plans and contracts.

For force account projects, the Forest Service project supervisor (who will have a Qualified Applicator Certificate) is responsible for ensuring that label directions and other applicable legal requirements are followed.

For contracted projects, the contracting officer, or the contracting officer’s representative will be responsible for ensuring that label directions and other applicable legal requirements are followed.

BMP 5.9: Pesticide Application Monitoring and Evaluation

Objective:

a. To determine whether pesticides have been applied safely, were restricted to intended target areas, and have not resulted in unexpected non-target effects.

b. To document and provide early warning of hazardous conditions resulting from possible pesticide contamination of water or other non-target areas.

c. To determine the extent, severity, and duration of any potential hazard that might exist.

Explanation: This practice documents the accuracy of application, amount applied, and any water-quality effects so as to reduce, or eliminate hazards to non-target species. Monitoring methods include spray cards, dye tracing (fluorometry), and direct measurement of particles in, or near water. Type of pesticide, type of equipment, application difficulty, public concern, beneficial uses, monitoring difficulty, availability of laboratory analysis, and applicable Federal, State, and local laws and regulations are all factors considered when developing the monitoring plan.

Implementation: The need for a monitoring plan will be identified during the pesticide use planning process as part of the project environmental evaluation and documentation.

2. The water-quality monitoring plan will specify:

a. Who will be involved and their roles and responsibilities;

b. What parameters will be monitored and analyzed;

c. When and where monitoring will take place;

d. What methodologies will be used for sampling and analysis, and the rationale behind each of the preceding specifications.

A water-quality specialist and the project leader will evaluate and interpret the water-quality monitoring results in terms of compliance with and adequacy of project specifications.

BMP 5.10: Pesticide Spill Contingency Planning

Objective: To reduce contamination of water by accidental pesticide spills.

Explanation: This is a preventative and corrective practice. The pesticide spill contingency plan prepared by each forest consists of predetermined actions to be implemented in the event of a pesticide spill. The plan lists who will notify whom and how, time requirements for the notification, guidelines for spill containment, and who will be responsible for cleanup.

Site-specific planning will be included in the project safety plan.

Implementation: Pesticide spill contingency planning will be incorporated into the project safety plan.

The site-specific environmental evaluation and resulting documentation will include public and other agency involvement in plan preparation. The plan will list the responsible authorities.

BMP 5.11: Cleaning and Disposal of Pesticide Containers and Equipment

Objective: To prevent water contamination resulting from cleaning, or disposal of pesticide containers.

Explanation: The cleaning and disposal of pesticide containers must be done in accordance with Federal, State, and local laws, regulations, and directives. Specific procedures for the cleaning and disposal of pesticide containers are documented in the Forest Service Pesticide Use Management and Coordination Handbook (FSH 2109.114), and State and local laws.

Implementation: The forest, or district Pesticide Use Coordinator (Qualified Applicator) will approve proper rinsing procedures in accordance with State and local laws and regulations, and arrange for disposal of pesticide containers when Forest Service personnel apply the pesticide.

When a contractor applies the pesticide, the contractor will be responsible for proper container rinsing and disposal in accordance with label directions and Federal, State, and local laws.

BMP 5.12: Streamside Wet Area Protection during Pesticide Spraying

Objective: To minimize the risk of pesticides inadvertently entering waters, or unintentionally altering the riparian area, SMZ, or wetland.

Explanation: When spraying pesticides for the purpose of meeting non-riparian area land management objectives, an untreated strip of land and vegetation will be left alongside surface waters, wetlands, riparian areas, or SMZ. The interdisciplinary team will establish strip width and, when county permits are required, in consultation with the county agricultural commissioner. When spraying pesticides for purposes of meeting riparian-area land management objectives, localized buffers around target species will be established and only hand application will be used.

Factors considered in establishing buffer strip widths are beneficial water uses, adjacent land uses, rainfall, wind speed, wind direction, terrain, slope, soils, and geology. The persistence, mobility, acute toxicity, bio-accumulation, and formulation of the pesticide are also considered. Equipment used, spray pattern, droplet size, and application height and past experience are other important factors.

Implementation: The interdisciplinary team will identify the perennial and intermittent surface waters, wetlands, riparian areas, and SMZ from onsite observation, and map them during project planning.

When included as part of the environmental evaluation and documentation, the project work plan, the protection of surface waters, wetlands, riparian areas, or the SMZ will be the responsibility of the project supervisor for force account projects, and the COR will be responsible on contracted projects.

The certified applicators must be briefed about the location of surface waters, wetlands, riparian areas, or SMZ. Buffer strip boundaries will be flagged, or otherwise marked, when necessary, to aid identification from the air.

BMP 5.13: Controlling Pesticide Drift during Spray Application

Objective: To minimize the risk of pesticide falling directly into water, or non-target areas.

Explanation: The spray application of pesticide is accomplished according to prescription which accounts for terrain and specifies the following: spray exclusion areas; buffer areas; and factors such as formulation, equipment, droplet size, spray height, application pattern, and flow rate; and the limiting factors of wind speed and direction, temperature, and relative humidity.

Implementation: An interdisciplinary team will prepare the prescription, working with the Forest or District Pesticide Use Coordinator during project planning.

For force account projects, the Forest Service project supervisor will be responsible for ensuring that the prescription is followed during application and for closing down application when specifications are exceeded.

On contracted projects, the contracting officer, or the contracting officer’s representative will be responsible for ensuring that the prescription is followed during application and for closing down application when specifications are exceeded.

National Core Best Management Practices

Chem-1: Chemical Use Planning

Objective: Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.

Explanation: Pollution risk from chemical use depends on chemical mobility and persistence, application mode and rate, and distance from water. Risk of entry to surface water is highest for broadcast and aerial treatments and for fine droplets. Risk to groundwater is highest over sandy soils, shallow water tables, and groundwater recharge areas. The planning process is the framework for incorporating measures to avoid or minimize impacts to soil and water resources into project design and management to reduce the risk of contamination from chemical use.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Use applicable practices of BMP Plan-2 (Project Planning and Analysis) and BMP Plan-3 (Aquatic Management Zone [AMZ] Planning) when planning activities that involve use of chemicals.
- Identify municipal supply watersheds; private domestic water supplies; fish hatcheries; and threatened, endangered, and sensitive aquatic dependent species and fish populations near or downstream of chemical treatment areas.
- Use Integrated Pest Management as the basis for all pesticide-use prescriptions in consultation with the unit Pesticide Use Coordinator.
- Select chemical products suitable for use on the target species or that meet project objectives.
    - Use chemicals that are registered for the intended uses.
- Consult the Materials Safety Data Sheet and product label for information on use, hazards, and safe handling procedures for chemicals products under consideration for use.
- Consider chemical solubility, absorption, breakdown rate properties, and site factors when determining which chemical products to use.
    - Use chemicals with properties such that soil residual activity will persist only as long as needed to achieve treatment objectives.
    - Consider soil type, chemical mobility, distance to surface water, and depth to groundwater to avoid or minimize surface water and groundwater contamination.
- Use a suitable pressure, nozzle size, and nozzle type combination to minimize off-target drift or droplet splatter.
- Use selective treatment methods for target organisms to the extent practicable.
- Specify management direction and appropriate site-specific response measures in project plans and safety plans (FSH 2109.14, chapter 60).
- Ensure that planned chemical use projects conform to all applicable local, State, Federal, and agency laws, regulations, and policies.
    - Obtain necessary permits, including Clean Water Act (CWA) 402 permit coverage.
    - Develop spill contingency plans.
    - Obtain or provide training and licensing as required by the label and State regulations.

Chem-2: Following Label Directions

Objective: Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.

Explanation: Directions found on the label of each chemical are detailed, specific, and include legal requirements for use. In brief, "...the label is the law..." with respect to chemical use. Not following label directions increases the risk of adverse effects to surface water or groundwater as a result of using chemicals inappropriate to the site, an inappropriate method of application, and an inappropriate application rate (too much or too little) to meet project objectives.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Incorporate constraints identified on the label and other legal requirements of application into project plans and contracts.
    - Be aware that States may have more restrictive requirements than the label instructions.
- Use fully trained individuals equipped with appropriate personal protective equipment to apply chemical treatments.
- Obtain State or Federal Pesticide Application Certification for staff supervising or applying chemical treatment application if required by law.
- Notify contractor's field supervisor when violations of label or project requirements have occurred.
- Stop operations that pose a safety hazard or when violations of project requirements have not been rectified.
- Report label violations to the appropriate enforcement agency.
- Respond to and report spills and other accidents.

Chem-3: Chemical Use near Waterbodies

Objective: Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies.

Explanation: Some chemicals used in terrestrial applications are toxic to aquatic flora and fauna, may overly enrich aquatic systems, and may pose a human health hazard if drinking water sources are contaminated during or after chemical applications. During application, chemicals may drift into waterbodies or other nontarget areas. After application, chemicals or chemical residues may enter surface water or groundwaters through runoff and leaching. Most State and local water quality standards include a general narrative standard that requires surface waters to be free from substances attributable to human-caused discharges in amounts, concentrations, or combinations that are toxic to humans, animals, plants, or aquatic life. To help protect surface waters and wetlands from contamination, a buffer zone of land and vegetation adjacent to the waterbody may need to be designated. Treatment within this zone may differ from that applied to upland areas or the buffer zone may be left untreated if necessary.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify during project planning those perennial and intermittent surface waters, wetlands, springs, riparian areas, and groundwater recharge areas that may be impacted by the chemical use.
    - Use field observations to verify the extent of these areas identified from aerial observations, maps, or geographic information system data, as needed.
- Determine the width of a buffer zone, if needed, based on a review of the project area, characteristics of the chemical to be used, and application method.
    - Consider the designated uses of water, adjacent land uses, expected rainfall, wind speed and direction, terrain, slope, soils, and geology.
    - Consider the persistence, mobility, toxicity profile, and bioaccumulation potential of any chemical formulation proposed for use.

    - Consider the type of equipment, spray pattern, droplet size, application height, and experience in similar projects.
- Prescribe chemicals and application methods in the buffer zone suitable to achieve project objectives while minimizing risk to water quality.
- Flag or otherwise mark or identify buffer zones as needed.
    - Clearly communicate to those applying the chemical what areas are to be avoided or where alternative treatments are to be used.
- Locate operation bases on upland areas, outside of wetlands or areas with channel or ditch connection to surface water and AMZs.
- Use clean equipment and personnel to collect water needed for mixing.
- Calibrate application equipment to apply chemicals uniformly and in the correct quantities.
- Evaluate weather conditions before beginning spray operations and monitor throughout each day to avoid or minimize chemical drift.
    - Apply chemicals only under favorable weather conditions as identified in the label instructions.
    - Avoid applying chemicals before forecasted severe storm events to limit runoff and ensure the chemical reaches intended targets.
    - Suspend operations if project prescription or weather limitations have been exceeded.
- Apply fertilizers during high nutrient-uptake periods to avoid or minimize leaching and translocation.
    - Base fertilizer type and application rate on soils and foliar analysis.
    - Use slow release fertilizers that deliver fertilizer to plants during extended periods in areas with long growing seasons when appropriate to meet project objectives.
- Monitor during chemical applications to determine if chemicals are reaching surface waters (see BMP Chem-6 [Chemical Application Monitoring and Evaluation]).
- Implement the chemical spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-4: Chemical Use in Waterbodies

Objective: Avoid, minimize, or mitigate unintended adverse effects to water quality from chemical treatments applied directly to waterbodies.

Explanation: Chemicals may be used to improve the growth of aquatic fauna and flora within lakes and streams, control invasive or other undesirable aquatic species, restore native biota, or remediate adverse atmospheric deposition. Chemicals may also be used as tracers for time of travel studies, dispersion studies, discharge measurement, and calculation of stream re-aeration, as well as for determining circulation and stratification within reservoirs, tagging pollutants, or many other applications.

Several factors affect the type and degree of impacts on aquatic resources, including chemical type, concentration, application rate, residence time, and decay rate; waterbody chemistry, volume, substrate, turnover, inflow, outflow, hydrograph, geology, geomorphology, designated uses, and other limnologic characteristics; and biologic species composition, habitat requirements, food web, population dynamics, and desired condition. Chemical treatments to surface waters may also affect groundwater through leaching, translocation, or interchange.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Coordinate project with State water quality and fish and wildlife agencies as necessary.
- Use chemicals registered for application in aquatic systems.
- Use the minimum concentration of chemicals required to be reasonably certain that treatment objectives would be met.
    - Consider physical attributes of the waterbody, water flow and turbulence, waterbody mixing time, water chemistry, target species, label directions, percentage of active ingredient in the formulation to be used, application method, and project objectives to determine chemical concentration to use.
    - Follow label directions near critical points such as water intakes or, if label is silent on this issue, consider using lower concentrations or nontreatment buffers.
    - Consider using pretreatment bioassay tests to determine if the recommended concentration will be effective to meet treatment objectives.
    - Adjust chemical concentration and application methods to account for the effect of thermal stratification in lakes or reservoirs to achieve treatment objectives.
    - Adjust chemical concentration and application methods in streams and flowing water to account for the effect that any barriers, diversion structures, beaver dams, seeps, springs, and tributaries may have on chemical dilution and mixing to achieve treatment objectives.
- Avoid applying chemicals in situations where they could enter nontarget waters.
- Determine the need to treat tributaries to standing waterbodies to meet treatment objectives.
    - Apply chemical treatment to tributaries before treating the standing waterbody.
- Determine the need for neutralization of chemicals applied directly to water.
    - Evaluate the environmental advantages and disadvantages of natural degradation compared to the use of neutralizing agents.
    - Use neutralization agents when the chemical treatment effects would cause unacceptable downstream impacts without intervention.
    - For neutralization of flowing water, determine a neutralization zone (e.g., mixing zone) based on time of travel below the application point where potential flora or fauna mortality can be expected before the chemical is completely neutralized.
- Determine the need for collecting dead flora or fauna.
    - Dispose of dead flora or fauna in an approved manner that does not adversely affect water quality.
- Monitor water quality and sediments pre- and post-chemical treatment at representative locations to evaluate relevant water chemistry and chemical concentrations (see BMP Chem-6 [Chemical Application Monitoring and Evaluation]).
- Implement the pesticide spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-5: Chemical Handling and Disposal

Objective: Avoid or minimize water and soil contamination when transporting, storing, preparing and mixing chemicals; cleaning application equipment; and cleaning or disposing chemical containers.

Explanation: Handling chemicals, chemical containers, and equipment can lead to contamination of surface water or groundwater if not done carefully. Spills, leaks, or wash water can contaminate soil and leach into groundwater. Residue left on containers or equipment can wash off during precipitation events and enter surface waters. Preparing and mixing chemicals and cleaning and disposing of chemical containers must be done in accordance with Federal, State, and local laws, regulations, and directives. Specific procedures are documented in the Forest Service Pesticide Use Management and Coordination Handbook (FSH 2109.14, chapter 40) as well as in State and local laws.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Transport and handle chemical containers in a manner that minimizes the potential for leaks and spills.
    - Inspect containers for leaks or loose caps or plugs before loading.
    - Secure containers properly to avoid or minimize shifting in transport.
    - Check containers periodically enroute.
    - Ensure arrangements for proper storage are in place before transporting chemicals.
- Manage and store chemicals in accordance with all applicable Federal, State, or local regulations, including label directions.
    - Store chemicals in their original containers with labels intact.
    - Locate chemical storage facilities at sites that minimize the possibility of impacts to surface water or groundwater in case accidents or fires occur.
    - At a minimum, ensure that containment of a complete spill from the largest container being stored is possible with the spill-kit materials at the storage site.
    - Check containers before storage and periodically during storage to ensure that they are properly sealed and not leaking.
- Locate operation bases in appropriate sites where possible spills would not enter surface waterbodies or groundwater aquifers.
- Ensure that mixing equipment, containers, and spill kits are in place and adequate for the project size and chemicals to be used.
- Follow label directions; applicable Federal, State, and local laws; and Forest Service direction for proper preparation and mixing of chemicals and cleaning and disposal of chemical materials and equipment.
    - When a contractor supplies the pesticide, the contractor is responsible for proper chemical preparation and mixing and container cleaning and disposal in accordance with label directions and Federal, State, and local laws.
    - Apply rinse water from empty chemical containers, mixing apparatus, and equipment clean up to the treatment area, not into the ground near streams.
    - Provide water from off site for cleaning equipment and application personnel rather than using onsite surface waters.
- Inspect application equipment to ensure that chemicals will not leak and the application prescription can be achieved.
- Implement the chemical spill contingency plan elements within the project safety plan if a spill occurs (FSH 2109.14, chapter 60).

Chem-6: Chemical Application Monitoring and Evaluation

Objective:

1. Determine whether chemicals have been applied safely, have been restricted to intended targets, and have not resulted in unexpected nontarget effects.
2. Document and provide early warning of possible hazardous conditions resulting from potential contamination of water or other nontarget resources or areas by chemicals.

Explanation: Monitoring of chemical applications is used to evaluate and document chemical application accuracy, amount, and effects on soils and water quality to reduce or eliminate hazards to nontarget biological or physical resources. Monitoring can occur before, during, and after chemical application depending on treatment objectives and monitoring questions. Monitoring methods may include any of the following: visual observations; vegetation surveys; use of spray cards; dye tracing (fluorometry); and sampling of water, soil, sediment, flora, or fauna to measure chemical presence in or near water. Monitoring needs and methods are determined in the project planning process and should consider treatment objectives; resource values at risk; chemical properties; potential for offsite movement; Federal, State, and local requirements; monitoring costs; and available project funding.

Practices: Develop site-specific BMP prescriptions for the following practices, as appropriate or when required, using State BMPs, Forest Service regional guidance, land management plan direction, BMP monitoring information, and professional judgment.

- Identify the following elements in all water resource monitoring plans and specify the rationale for each:
  - What are the monitoring questions?
  - Who will be involved and what are their roles and responsibilities?
  - What parameters will be monitored and analyzed?
  - When and where will monitoring take place?
  - What methods will be used for sampling and analyses?
  - How will Chain of Custody requirements for sample handling be met?
  - What are the criteria for quality assurance and quality control?
- Consider the following factors when developing monitoring questions:
  - The physical or biological resource of concern, including human health.
  - Applicable Federal, State, and local laws and regulations.
  - Type of chemical.
  - Type of application equipment used and method of application.
  - Site-related difficulties that affect both application and monitoring.
  - Public concerns.
  - Potential benefits of the application.
  - Availability of analytic methods, detection limits, tools, and laboratories.
  - Costs of monitoring and resources available to implement monitoring plan.
- Choose monitoring methods and sample locations suitable to address the monitoring questions.
  - Consider the need to take random batch or tank samples for future testing in the event of treatment failure or an unexpected adverse effect.
- Monitor sensitive environments during and after chemical applications to detect and evaluate unanticipated events.
- Use U.S. Environmental Protection Agency-certified laboratories for chemical sample analysis.
  - Use appropriate containers, preservation, and transportation to meet Standard Methods requirements.
  - Implement proper Chain of Custody procedures for sample handling.
- Evaluate and interpret the results of monitoring in terms of compliance with, and adequacy of, treatment objectives and specifications.

For force account projects, the Forest Service project supervisor will be responsible for ensuring that the prescription is followed during application and for closing down application when specifications are exceeded.

On contracted projects, the contracting officer, or the contracting officer's representative will be responsible for ensuring that the prescription is followed during application and for closing down application when specifications are exceeded.

Appendix F: Monitoring Plan

Objectives

The objectives of this Water Quality Monitoring Plan are to:

- Protect all beneficial uses of water by meeting state and federal water quality standards during both herbicide application and in subsequent peak runoff periods;
- Avoid or minimize water contamination due to herbicide use;
- Insure the project is implemented in accordance with the Best Management Practices (BMP's).

Two actions are required to achieve the above objectives. The first and foremost action is to determine if there was any unplanned herbicide introduction to streams, rivers, standing water and groundwater aquifers to the maximum extent possible. This action addresses the potential for contamination during application due to miss-application or accidental releases. The second action is to determine if water quality standards have been met by monitoring for any project-related contamination of the applied herbicide that may have moved subsurface through the soil and entered into any surface waters. This is accomplished by sampling surface water to detect off-site migration and persistence of contamination.

Purpose

The purpose of this Water Quality Monitoring Plan is:

- Determine if herbicides have moved off-site into surface water after application through overland flow, leaching and/or subsurface flow.
- Determine the amount of chemical residue that is reaching surface water.
- Determine if chemical residue has entered water and how long it continues to enter the water.

The following measures will be taken to ensure that the herbicide does not enter water during application:

- Herbicide application will be by backpack sprayers or on-the-ground applicators wicking the target species under restricted weather conditions to minimize drift.
- Colorant will be added to the spray formulation to track for any drift.
- When in close proximity to surface water, the applicator will direct the nozzle away from the water and will only apply herbicide if the wind is still or blowing away from the water.

Monitoring Plan

This section of the Water Quality Monitoring Plan describes what monitoring is required for the project and where, when and how it will be accomplished. The frequency and location of water quality monitoring is based upon chemical characteristics that influence mobility and persistence of herbicides in soil and water. In addition, climatic regimes and timing of application also affected monitoring strategies.

In general, waters that provide high-value beneficial uses that have the greatest risk of being contaminated should be considered sensitive areas and receive highest priority and intensity of monitoring effort. The beneficial uses of the Middle Fork of the Feather River ranges from fish habitat/aquatic life, recreation (e.g. fishing, kayaking, swimming etc.) and irrigation. The Middle Fork of the Feather River is not used directly as a potable water source.

Pre-Treatment Monitoring

Pre-treatment monitoring may consist of attaining surface water samples prior to treatment. Samples will be sent to a water quality lab for analysis to determine presence of background herbicide concentrations in the surface water. The results of this analysis will be used as existing conditions prior to treatment.

Treatment Monitoring (Early Warning)

Treatment monitoring will consists of “early warning” monitoring to determine if water protection measures are being implemented correctly and to identify possible hazardous conditions to nearby beneficial users. Early warning monitoring can also detect where adjustments in application operations are needed to protect beneficial uses.

Early warning monitoring is direct visual observation of the herbicide application operation. The observer will ensure the functional integrity of the no-treatment areas. Colorant added to the herbicide mix can be used to aid in detecting herbicide drift. If any of the observers see herbicide entering water, spray operations should be stopped and appropriate corrective measures taken. In addition, surface water sampling may be warranted as determined by site-specific scenarios that indicate that water quality may have been affected.

Post-Treatment Monitoring

Post-treatment monitoring is sampling surface water to detect presence of herbicide. If herbicide is detected in any of these samples, additional samples may be necessary to evaluate the magnitude and persistence of contamination. The water quality sampling will be taken during the first storm runoff period following treatment that produces runoff and/or flow release that is typically greater than 1 inch precipitation within a 24 hour period.

Laboratory analyses of surface water samples track herbicide movement in water. These samples will provide data to determine compliance with water quality standards and to assess effectiveness of protection measures. Considerations in sampling include sampling location(s), sampling frequency and sample handling and analysis. The specific location(s) and the sampling strategy are described below.

Sampling Location

Monitoring locations would be identified prior to application. These locations are subject to change or deletion pending field review. If any are determined to be unsuitable, backup locations would also be selected. The actual locations of all sampling points would be kept confidential in the planning file until after the samples have been analyzed for chemical residues. Each new monitoring point would be identified on the ground and given a unique designation (e.g., A05, B05 or C05). This numbering scheme would also be recorded on monitoring station maps and on the monitoring station narrative description. This narrative description would be completed during the initial visit (before herbicide application).

Sampling locations will be located immediately below the treated site(s) to detect herbicide concentration with minimal dilution. Depending on local conditions, sampling may also be conducted further downstream of the project analysis area, at outlets of watersheds exiting the Proposed Action analysis area and further downstream if necessary. Sampling locations should have good access, especially during storms, and be close together if possible, to reduce travel time between sites. Locations should be marked with stakes, flagging or tags and referenced when they are established in the field. Selected sample locations should have favorable flow conditions, such as adequate depth for sampling, good water mixing and a stable cross section. The site should be as free as possible from excessive sediment.

Sampling Frequency

Following herbicide applications, surface water samples will be taken during storm runoff periods to determine the amount of herbicide, which may have entered the water through surface runoff. If herbicide is detected in any of these samples, additional samples may be necessary to evaluate the magnitude and persistence of contamination.

The sample, or samples, should be taken during the rising limb of the hydrograph during the first significant runoff-producing storm occurring after herbicide application. A significant storm and the rising limb of the hydrograph will be defined by the project hydrologist. For spring time applications, this storm may be within a few days to a few weeks. For summer applications, the first runoff-producing storm may be a summer thunderstorm or may not occur until fall. All samples should be taken on the rising limb of the hydrograph since the most concentrated amount of herbicide would be expected to pass the sampling location at that time.

Sample Collection and Analysis

Samples will be taken by personnel not otherwise involved in the herbicide application operation. Extreme care must be taken to prevent sample contamination. The collector must not have any herbicide or other contaminant on his/her hands or clothing. Sample containers must not be transported or stored with herbicides.

Instantaneous samples should be as representative as possible of the total volume of water passing the monitoring location at any moment. Samples should be collected without stirring up bottom sediments or introducing surface debris into the water. The samples should be taken in the thalweg at about 2/3 of the depth of the water column. Do not sample in slow-moving pools or where there is a noticeable eddy effect. The container should be slowly lowered into the main flow of the stream. The bottle opening should be facing upstream so that water does not contact the sampler's hands or boots before entering the bottle. Sufficient volume should be collected to allow for adequate sample analysis and permit running a duplicate.

Other Considerations

Samples can be composited to reduce the cost of laboratory analysis. A composite sample is a combination of equal parts of two to five samples. It is most commonly used for single location and permits one sample to represent a time interval or a stream cross-section where uniform mixing is doubtful.

Generally, sample containers should be amber glass bottles with teflon lids. Sample bottles should be available from the lab doing the analysis. In the field, samples should be stored in a cooler of ice. Some samples such as glyphosate may need to be frozen. Check with the lab for sample handling procedures. Samples should be transported to the lab preferably within two days from time of collection. Duplicate samples not analyzed must be stored in a cool, dry location, completely removed from herbicides or other chemicals for no longer than 6 months. A half-pint sample of a batch of spray formulation should be taken and kept until analysis reports are complete.

Each sample must be clearly identified and all pertinent information correctly and completely entered into the location record and recorded on a tag or label securely attached to the container. Identification information on the sample and form must be the same. Identification tags must include: 1) location identification 2) date and time of sample collection, 3) name of person collecting the sample and 4) type of sample. Identification tags and sample forms should be checked for accuracy and completeness prior to submission for analysis.

Analysis of samples should be coordinated through the forest or project hydrologist. A state certified lab will be used to do the analysis. Obtain QC/QA information from the lab.

Project Evaluation and Reporting

This section of the Water Quality Monitoring Plan lists the project records that will be kept, and how the project will be evaluated and reported.

A record consisting of maps, field notes, correspondence with lab and sample point history will be filed with the project hydrologist. The maps should show treatment units beneficial uses and monitoring locations. Field notes should include weather conditions - precipitation, temperature and wind, two days before, during and after application. Correspondence with the lab should include the current instructions regarding handling procedures and the results of sample analysis. The sample point history will include the complete record of the sample location in addition to the following:

1. Type of chemical, formulation and manufacturer.
2. Method of application.
3. Weather conditions during spraying and water monitoring.
4. Any unusual occurrence that might affect water analysis results.
5. Application formula and rate.
6. Description of treatment units within drainage area of sample point.
7. Record of correspondence with organizations, groups and individuals concerning results of the water monitoring and water quality.

Reports regarding spray progress in relation to water quality protection measures will be made to the project manager as often as necessary during herbicide application. The purpose of these reports will be to determine if any changes in preventive measures are needed.

At the completion of the project, or more frequently, evaluation of the effectiveness of protective measures will be based on visual observations of target vegetation once it has had a chance to die and the results of water sampling. A summary report will be prepared that will contain analysis results and a narrative of the effectiveness of the BMP's implemented to protect water quality. This report will be kept on file with the forest or project hydrologist. If necessary copies will be sent to the appropriate Forest Service officials, to the Central Valley Regional Water Quality Control Board and to local recipients such as the County Agricultural Commissioner, interested publics and the media.